SCIENTIFIC AMERICAN

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A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

Vol. LVIII.—No. 4. [NEW SERIES.] NEW YORK, JANUARY 28, 1888. [$3.00 per Year.

IRON WORKS OF THE SYRACUSE MALLEABLE IRON COMPANY.

The introduction of malleable castings to take the place of drop forgings is one of the features of modern metallurgy. The adoption of this process has enabled the metallurgist to produce much more ornamental designs than could be produced by drop forging without the use of the most expensive kinds of dies.

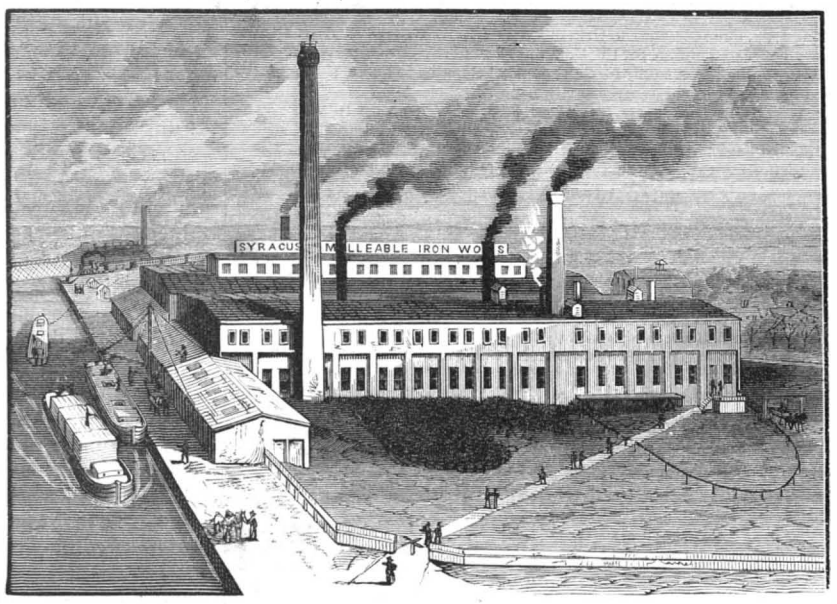
Malleable castings combine the qualities of wrought and cast iron. As intricate designs as can be produced by the highest grades and most liquid running cast iron are here made of a metal possessing the strength, malleability, and other qualities of wrought iron.

We illustrate in the present issue the works of the Syracuse Malleable Iron Company. This is one of the great metal works of the United States. In it upward of 225 workmen are employed in conducting the various operations incidental to the production of every variety of malleable castings. A general view of the works, which cover an area of four and a half acres, is given. In the background is the foundry, in area 100 × 200 feet. In front of this is the main building, which is 60 × 235 feet. The latter is devoted to the operations of annealing, tempering, pattern making, trimming, etc. It also contains the shipping room, in which the finished castings are packed in barrels for transportation by rail or canal, the pattern vault, engine, boiler, and office. The engine is a 60 horse power straight line engine, one of the leading high speed engines of the country. The boiler is of 100 horse power, and is of the Abendroth & Root manufacture. Two large chimneys rise from the main building, which produce the draught for the annealing kilns, as their draught is entirely a natural one. The taller chimney is 150 feet high. The right hand portion of this building is divided into three stories. In the background is seen the stable in which the horses are kept, while on the banks of the canal, to the left, are three coal sheds. The longer one of these is 110 × 30 feet, the next is 60 × 30, and the one in the foreground is 40 × 60. As will be seen, the facilities for shipping the product or for receiving the raw material are unexcelled. In the back of the factory, within 200 yards of it, are the tracks of the New York Central and the West Shore Railroad, while the Erie Canal runs directly at its side. The materials received include anthracite and bituminous coal, fire sand, moulding sand, luting clay, fire bricks, etc.

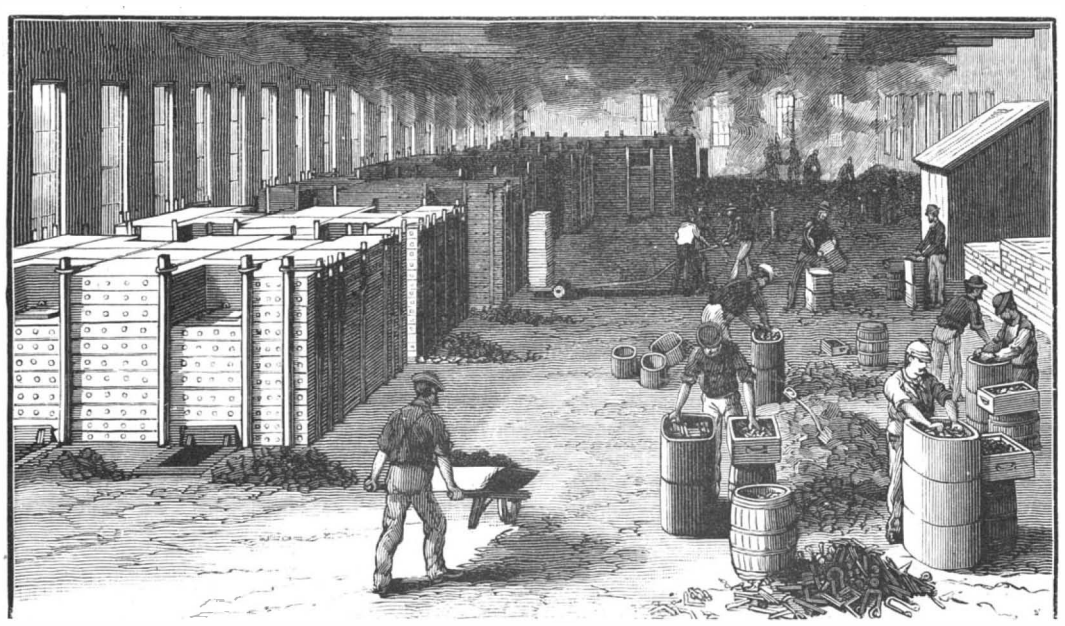
The first steps of the process are executed in the foundry, which include the making of the moulds from the models, the melting of the pig iron, and the casting. The iron is melted in an open hearth furnace, constructed according to the most modern type, in which the heat is derived by direct radiation from the flame and from the furnace walls, contact with the coal impurities being entirely avoided. In this way a pure quality of casting is produced, as the metal is not contaminated with sulphur. Each furnace can melt four heats a day, disposing of four tons of iron in each heat. They are run on alternate days, every other day being devoted to cleaning. The blast is supplied by a Root force blower.

Iron containing a high percentage of combined carbon is used, as making the most perfect running metal, but with it are mixed also some of the lower numbers. All along the walls at the sides of the foundry and through its center are the moulding benches. Here the models

(*Continued on page 50.*)



GENERAL VIEW OF THE WORKS.



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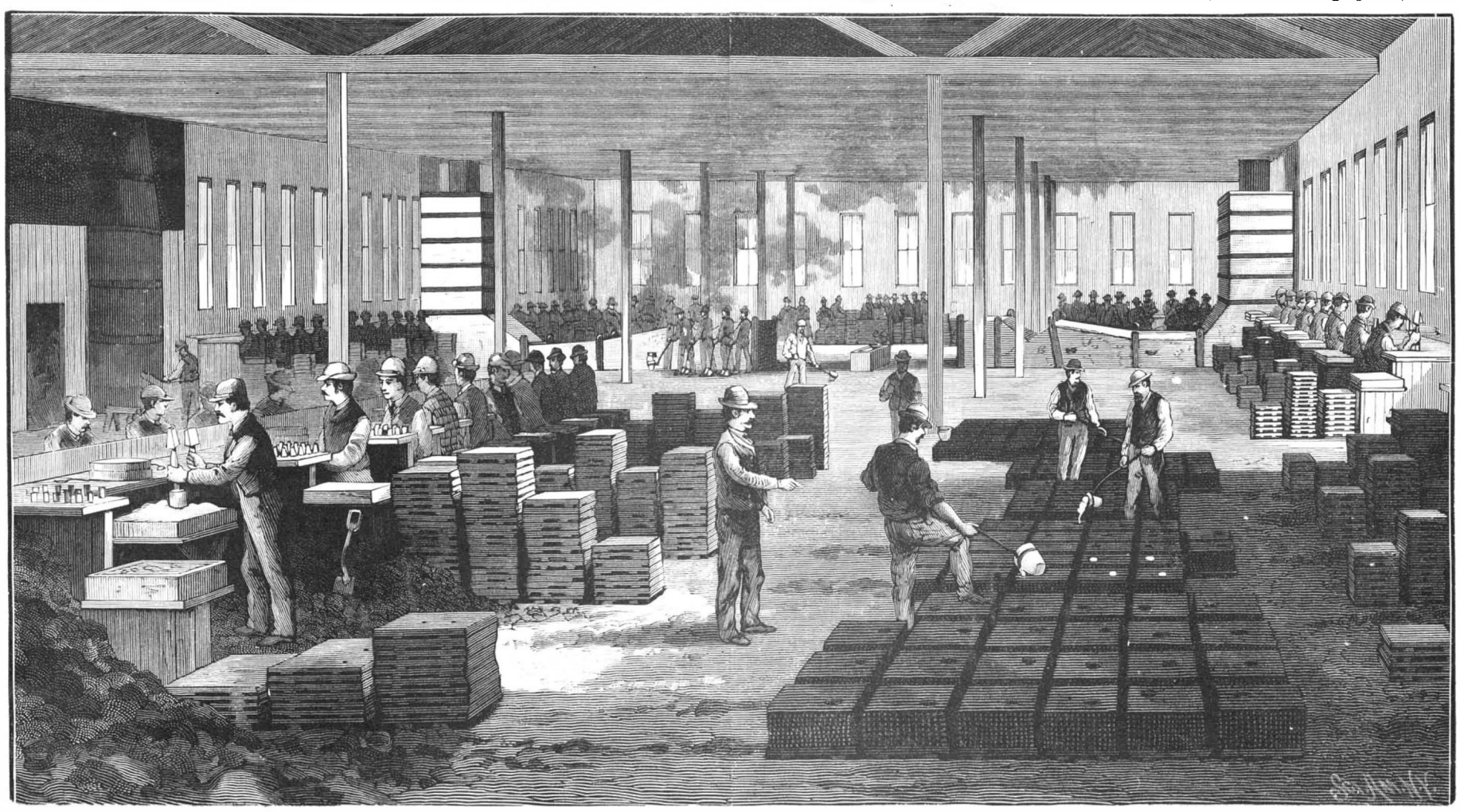

THE FOUNDRY OF THE SYRACUSE MALLEABLE IRON WORKS.

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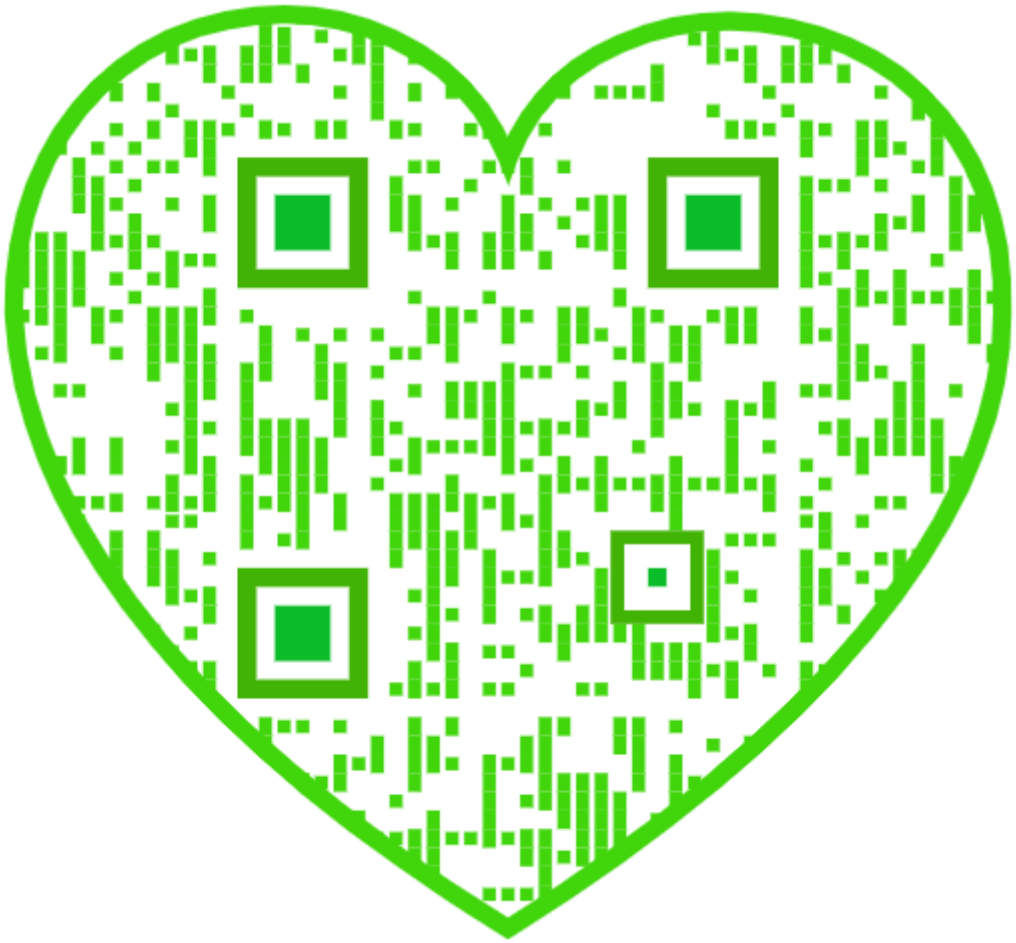

Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT

No. 361 BROADWAY, NEW YORK.

O. D. MUNN. A. E. BEACH.

TERMS FOR THE SCIENTIFIC AMERICAN.

One copy, one year, for the U. S. or Canada.....$3 00
One copy, six months, for the U. S. or Canada..... 1 50
One copy, one year, to any foreign country belonging to Postal Union, 4 00
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Australia and New Zealand.—Those who desire to receive the SCIENTIFIC AMERICAN, for a little over one year, may remit £1 in current Colonial bank notes. Address

MUNN & CO., 361 Broadway, corner of Franklin Street, New York.

The Scientific American Supplement

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NEW YORK, SATURDAY, JANUARY 28, 1888.

Contents.

(Illustrated articles are marked with an asterisk.)

Air indicator, pure..... 57
Aqueous formic acid, pure, secretion of..... 57
Asbestos, firemen clothed in..... 57
Books and publications..... 58
Bricks, effect of atmosphere on... 52
Building material, fireproof..... 50
Business and personal..... 58
Copyright question, the..... 48
Corn laws, German..... 52
Correspondence..... 53
Dam, Bear Valley, great..... 49
Dumb bell therapeutics..... 53
Eclipse of the moon, total..... 51
Engineering, naval..... 55
Faucet, improved*..... 51
Fire precautions as to woodworking shops in Berlin..... 52
Four things worth knowing..... 54
Gas, new, hydride of nitrogen... 51
Greenish-brown patina for brass and bronze..... 57
Guard rail for vehicle wheels*.... 51
Gun, great steel, casting..... 48
Horses, protection for, against fire..... 48
Inventions, agricultural..... 58
Inventions, engineering..... 58
Inventions, index of..... 59
Inventions, miscellaneous..... 58
Iron, preservation of..... 53
Iron works, Syracuse Malleable Iron Company*..... 47
Labor troubles, six years'..... 53
Lime, use of, to neutralize sorghum juice..... 5
Magnesium in electric batteries.. 51
Mason's float handle*..... 51
Meat, preservation of, by sugar.. 48
Memory, tricks of..... 56
Morris type writer*..... 54
Myopia..... 53
Naphtha springs, Baku..... 52
Notes and queries..... 59
Photographic notes..... 49
Planets, position of, in February. 49
Poles, telegraph, preserving..... 51
Quartz, electrical attraction of... 50
Railway rail chair and tie, combined*..... 51
Ratchet and lever mechanism*... 52
Ring, the, removing..... 55
Secrets, stolen..... 57
Seeds, apparatus for testing*..... 51
Sense organs, reciprocal influence 52
Sewers of Paris..... 52
Sheep, African, in the Berlin Zoological Gardens*..... 55
Smelting process, the Parkes..... 56
Steel, experience with..... 57
Sugar patent, Prof. Swenson's.... 53
Syracuse Malleable Iron Works*.. 47
Thill coupling, improved*..... 51
Type writer, Morris*..... 54
Typhoid poison..... 57
Walls, washable, in cottages..... 50
Water works, Cardiff..... 49
Wheat crop of the world..... 53

TABLE OF CONTENTS OF

SCIENTIFIC AMERICAN SUPPLEMENT

No. 680.

For the Week Ending January 28, 1888.

Price 10 cents. For sale by all newsdealers.

PAGE

I. ARBORICULTURE.—Barberries.—A valuable and beautiful late flowering shrub for lawn decoration.—1 illustration... 10058
Pot Vines.—Grapevines grown in ten inch flower pots.—Their progress and early bearing.—1 illustration... 10058

II. ASTRONOMY.—Astronomical Telescopes at the Manchester Exhibition.—Sir Howard Grubb's instrument.—Its mounting and method of motion.—3 illustrations... 10055
The Age of the Stars.—An interesting and important lecture by Prof. JANSSEN.—First installment, dealing with early theories and workers... 10056

III. CHEMISTRY.—Carbon Electrodes in the Decomposition of Acids.—Debray and Pechard's recent investigation summarized.—Curious disaggregation of carbon... 10070
Chemical and Allied Industries.—By WATSON SMITH.—Fine chemicals, alkaloids, essences, and extracts condsidred in detail.—Continuation of this long and exhaustive treatise... 10067
Isolation of Fluorine.—An exhaustive review of the last developments in Moissan's researches.—The properties of elemental fluorine... 10068

IV. ENGINEERING.—Oil Furnaces at the Forth Bridge.—By E. W. MOIR.—Rivet and heating furnaces using waste blast furnace oils for fuel.—4 illustrations... 10063
Street Railway Sleeping Car.—Sleeping car in use on a 250 mile horse railroad in the Argentine Republic.—General character of the route of the longest horse railroad in the world.—2 illustrations... 10063

V. ENTOMOLOGY.—Experiments upon the Color Relations between Phytophagous Larvæ and their Surroundings.—By E. B. POULTON.—Adjustable color relations in larvæ of lepidoptera.—The determination of tint by surroundings... 10060
Observations on the Female Form of Phengodes laticollis Horn.—By GEORGE F. ATKINS.—A luminous larviform beetle.—Full notes as to duration and intensity of its glow.—1 illustration.. 10059

VI. GEOLOGY.—Geology Explained in the Simplest Form.—An interesting object talk upon the formation of three typical forms of rock... 10057

VII. MISCELLANEOUS.—A Home-made Incubator.—By P. H. JACOBS.—A paper of interest to poultry raisers, giving a practical account of how to make and manage an incubator.—4 illustrations... 10059
An Elephant Hunt in Ceylon.—A graphic description of a hunting trip in the primeval forests of Ceylon; bridge making and elephant hunting.—4 illustrations... 10060
Curious Inventions.—1. Optical illusions. 2. An eighteenth century caricature. 3. Magic Coins.—Some curiosities in natural magic, illusions and caricature.—6 illustrations... 10061

VIII. NAVAL ENGINEERING.—To Prevent Rolling of Vessels.—Rolling tanks described and illustrated; the latest device for restraining a ship's motion.—3 illustrations... 10063

IX. PHOTOGRAPHY.—A New Photometer for Use in the Field.—An ingenious pocket apparatus for determining period of exposure for gelatine plates.—1 illustration... 10068

X. PHYSICS.—A New Instrument for the Measurement of Radiation.—By C. C. HUTCHINS.—A sensitive quick acting modification of the thermopile.—1 illustration... 10068

XI. TECHNOLOGY.—Corrosion of Lead Pipes.—A review of the causes of corrosion, the chemical characteristics and extent of deterioration... 10070
Magnetic Separator.—An improved apparatus for separating iron from brass and other chippings and turnings.—1 illustration... 10066
The Development of the Mercurial Air Pump.—By Professor SILVANUS P. THOMPSON.—Second portion of this important lecture, with descriptions of the more recent mercurial pumps.—13 illustrations... 10064

THE COPYRIGHT QUESTION.

There is a decided inclination among our legislators to regard the international copyright question from a purely mercantile point of view rather than from the moral one, which has been recommended them. They discovered that such a law would give the foreign publisher a great advantage over the American publisher without in any way furthering the interests of the American reader, and that was, to their minds, a sufficient reason for refusing their assent to its passage. Without desire to give an opinion as to the truth or fallacy of the reasoning and its conclusion, we propose to review the main arguments. Hand labor in Europe is, of course, much cheaper than here; typesetting, the most costly part of making a book, is done in England, for example, at about half our rates, and other labors pertaining thereto in somewhat similar proportion. Under a copyright law, a foreign work, even if it were necessary to republish it here, according to the provision made in Senator Hawley's amendment to the original bill, could only be sold to the American reader under the restrictions as to price made by the foreign publisher, which, there is little doubt, would make it far more expensive than now, if it did not take it altogether out of the reach of the general public. Without the amendment referred to, many great publishing houses on this side the water, which employ thousands of workmen, would, it is said, be driven from the business, and the American market flooded with cheap reprints of foreign works. Thus the general public, though able to get old works sufficiently cheap to prevent competition from American publishers, would be forced to pay an exorbitant rate for new books or go without them.

Mr. Andrew Lang, the writer, in an article on International Copyright in *Longman's Magazine*, says: "For my own part, I cannot pretend to care much about the matter as [here he refers to an American cheap publisher] does not sell my engaging works on the "Evolution of Ritual," and so forth, at sixpence. Perhaps it would not remunerate him to do so. But the person one is sorry for is the American novelist. How can the young and ardent literary 'schoolmarm' hope to sell her 'Popsy's Ways; a Connecticut Idyl,' for $1.50, when you can have 'Treasure Island,' 'Kidnapped,' and the 'New Arabian Nights,' all in one hideous pamphlet for ten cents? The native American producer is ruined by English cheap labor, by kidnapped labor, by labor which is not even paid for its keep, though the laborer has one of the privileges of slavery, and is both flogged and preached at, sometimes, in the land of his captivity."

Mr. Lang makes a good argument, but of a kind which rarely, if ever, appeals to the consciences of legislative economists, whatever their nationality. Such persons invariably seek to discover on which side a favorable or unfavorable decision would bring the balance of trade, taking less account, perhaps, than they should of what the severe moralist would regard as international justice. In the present case, our legislators believe that, whereas an international copyright law might bring a few more dollars to a handful of American authors, it would deprive thousands of American workmen of remunerative employment.

As to the piratical incursions of the American publisher, Mr. Brander Matthews has shown in a recent paper that the British publisher goes a peg further in literary effrontery. The American cheap reprint of the foreign author's work invariably bears his name and reports him *verbatim*, whereas in England the pirated editions of American authors frequently bear fictitious names and suffer various forms of mutilation. Those portions which are supposed not to be suitable for English reading are cut out, changed, or rewritten, and American scenes are changed to English. Sometimes the whole tenor of the story is changed, and in the case of Dr. Holland's "Arthur Bonnicastle," the last chapter was altogether rejected, a new one, written by some unknown person on the other side of the water, taking its place. Gen. Lew Wallace, on a recent visit to England, discovered that an English publisher had issued his "Ben Hur" under another title, and with a new preface, to which his name was affixed. Many similar instances could be cited.

Casting a Great Steel Gun.

On Wednesday, January 11, the largest gun ever made by direct steel casting was cast of Bessemer steel at Pittsburg, Pa. Sixteen thousand five hundred pounds of melted iron were charged into the converters. After the blow the fluid steel was run into the mould. The latter stood on end in a casting pit. Two minutes sufficed for pouring the metal into the flask. All went well apparently, but it was only after its removal from the mould that an opinion as to the success of the operation could be pronounced. On Monday, January 16, it was taken from the mould, and the casting was pronounced perfect, both by Superintendent Hainsworth, of the Pittsburg Casting Co., and by the government representatives. The gun is to be of 6 in. caliber, with 7½ in. powder chamber; largest diameter, 23 in., and outside diameter of muzzle, 10 in.; initial velocity of projectile, 2,000 ft.; pressure in chamber, 15 tons. Its total weight when finished will be 5½ tons. After completion it will be subjected to extremely severe tests at Annapolis, Md.

The casting of this gun is an event of much importance. If the piece proves a success, it may revolutionize the construction of guns in this country. It will do much to put the great question of supremacy between cast and built-up guns to the test of practical trial. It also is a step that may bring about the trial of aluminum-bronze guns. Should it be shown that casting can produce a satisfactory cannon, then an additional inducement will be created for trying aluminum-bronze, a metal that is much easier melted than steel, and that in strength and generally resistant qualities equals or surpasses it.

The progress of the new piece will be watched with much interest both here and abroad. It is satisfactory to feel that the United States may yet inaugurate a new departure in heavy ordnance. We have already described the casting of the great guns in the South Boston Iron Works.* The process described and illustrated will give a pretty accurate idea of the manipulations to which the new steel gun has been and will be subjected. It seems evident that if cast metal guns are to be satisfactory weapons, the proof will be given in this country. In thus casting guns the saving in expense is very great. The new piece will cost but a fraction of the sum which would be expended upon a built-up gun of like caliber.

Protection for Horses against Fire.

It is to be hoped that before long some simple and practical way will be arrived at for preventing, or at least lessening, the terrible loss of life among the horses which has hitherto attended every stable fire of importance.

A device intended, in case of fire, not only to release simultaneously all the animals, but to turn them out of the building, has recently been put on trial in a New York stable, and seems simple enough. In the principal alleyway leading into the stable is placed a wheel about three feet in diameter, which is connected by shafts with the stalls. A heavy weight is suspended from the circumference of the wheel. Delicate thermostats placed about the ceiling of the stable are arranged so that a very slight increase of temperature will, by expansion, complete an electrical circuit which will loosen the weight suspended from the wheel, and thus set the machinery in motion. A bell will ring, the bolts of the stall will be drawn, the halters of the horses will be loosened, and lastly, a double stream of water will be thrown into the face of each horse from two jets placed over the head of the stall. The effect of this shower bath will be to cause the horse to back out of his stall. He will find himself free, the doors of the stall and the stable open, and, in his fright at the fire and the unusual commotion, will naturally secure his own safety—at least that is the inventor's programme, though whether it will be carried out in practice remains to be seen. Besides, this doesn't dispose of the question of how to save the poor beasts stabled on the second floor, and until that problem is solved we may look at any time for a repetition of the shocking scenes which attended the burning of the Belt Line stables in New York and of those in South Brooklyn a few weeks ago.—*Fire and Water.*

Preservation of Meat by Sugar.

It results from a special report made to the French Minister of Agriculture that sugar is an excellent agent for preserving meat, and possesses some advantages over salt. In fact, salt absorbs a portion of the nutritive substances and of the flavor of meat. When an analysis is made of a solution of the salt dissolved by water contained in meat, we find albuminoid bodies, extractive substances, potassa, and phosphoric acid. Salt deprives meat of these substances so much the more readily in proportion as it enters the tissues more deeply or acts for a longer time. It then results that the meat, when taken from the saline solution, has lost nutritive elements of genuine importance.

Powdered sugar, on the contrary, being less soluble, produces less liquid. It forms around the meat a solid crust, which removes very little water from it and does not alter its taste. Thus preserved, it suffices to immerse the meat in water before using it. Although this treatment costs a little more than preservation by salt, account must be taken of the final result and of the loss prevented, which offsets the difference in cost between the two preservative agents. We think that navigators might profit by this.—*Revue Generale de la Marine Marchande.*

WE have received from James A. Alexander, 68 Wall Street, New York, General Agent of the Ætna Insurance Co., of Hartford, a statement of its condition December 31, 1887. It has a net surplus of over $3,300,000, or larger than the capital of any fire insurance company in this country, and has paid in sixty-nine years losses exceeding sixty-one million six hundred thousand dollars.

* See SCIENTIFIC AMERICAN, Vol. 55, No. 13, pp. 191, 197.

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POSITION OF THE PLANETS IN FEBRUARY.

JUPITER

is morning star, and is perhaps the most interesting member of the sun's family during the month, rising earlier and growing brighter as he approaches the earth, a superb object in the sky from the small hours of the morning till dawn. He is in quadrature with the sun on the 24th. An observer commanding a view of the southeastern sky will recognize him at a glance. Jupiter rises on the 1st at 2 h. 28 m. A.M. On the 29th, he rises at 12 h. 51 m. A.M. His diameter on the 1st is 33·4″, and he is in the constellation Scorpio.

VENUS

is morning star. Her luster diminishes as she approaches the sun, but she is still fair to see in the morning dawn. Observers will note the rapidly increasing distance between Venus and Jupiter, the former rising on the 1st 2 h. 10 m. before the sun, and the latter rising 4 h. 30 m. before the sun. Venus rises on the 1st at 4 h. 48 m. A.M. On the 29th, she rises at 5 h. 8 m. A.M. Her diameter on the 1st is 15·2″, and she is in the constellation Sagittarius.

MARS

is morning star. He may easily be recognized as a bright, ruddy star northeast of Spica, rising on the 1st an hour before midnight, and remaining near his bright neighbor during the month. Mars rises on the 1st at 11 h. 11 m. P.M. On the 29th, he rises at 9 h. 48 m. P. M. His diameter on the 1st is 9·4″, and he is in the constellation Virgo.

URANUS

is morning star. He is near Spica, on the northwest. A telescope will bring him to view as a small sphere of a delicate green color. Uranus rises on the 1st at 10 h. 35 m. P.M. On the 29th, he rises at 8 h. 43 m. P.M. His diameter on the 1st is 3·8″, and he is in the constellation Virgo.

SATURN

is evening star. He is now in fine condition for observation, having just passed opposition. Any one can find him who knows Pollux and Procyon, for he is east of them, and forms a triangle with them. He is visible in the northeast as soon as it is dark enough for the stars to come out. Saturn sets on the 1st at 6 h. 44 m. A.M. On the 29th, he sets at 4 h. 48 m. A.M. His diameter on the 1st is 19·2″, and he is in the constellation Cancer.

MERCURY

is evening star. He reaches his greatest eastern elongation on the 17th, and is at that time, and for a few days before and after, plainly visible to the naked eye. He sets on the 17th an hour and three-quarters after the sun, and must be looked for in the west, three-quarters of an hour after sunset, about 8° north of the sunset point. Mercury sets on the 1st at 5 h. 53 m. P.M. On the 29th, he sets at 6 h. 18 m. P.M. His diameter on the 1st is 5·2″, and he is in the constellation Capricornus.

NEPTUNE

is evening star. He is in quadrature with the sun on the 16th. Neptune sets on the 1st at 2 h. A.M. On the 29th, he sets at 12 h. 10 m. A.M. His diameter on the 1st is 2·6″, and he is in the constellation Taurus.

At the close of the month, Venus, Jupiter, Mars, and Uranus are morning stars; Mercury, Saturn, and Neptune are evening stars.

Cardiff Water Works.

About two years ago the work of laying down thirty-one miles of large water pipes between Llanishen and Cwmtaff, as a necessary means of water passage from the Breconshire watershed for the supply of Cardiff, was commenced. The whole line of conduit is now nearly completed. A supply of water could now be sent to Llanishen for use at Cardiff. This water could be taken from the river after proper allowances are made for Cyfarthfa Steel Works and other establishments. The balancing reservoir at Rhubina, the nearest of its kind to Llanishen, is practically complete. It is at high level, and is intended for the future high level service of Cardiff, Penarth, Llandaff, and Whitchurch. Blackbrook balancing reservoir is nearly finished, and that at Cefn will be ready in about a month. These three balancing reservoirs are arched over. The upper section of the pipes where the No. 2 —or Cantreff—reservoir is being constructed is 1,000 ft. above the Cardiff level; Llanishen is 150 ft. above Cardiff, and Rhubina is about 100 ft. above Llanishen.

The Cantreff reservoir will be completed in about two years, and its capacity will be about 300,000,000 gallons. Two others are contemplated—Nos. 1 and 3—one of which will be located above and the other below the No. 2 works, which are being constructed at the root of the upper portion of a drainage area of 4,000 acres. The pipes have been obtained at an aggregate cost of about $600,000, and the laying of the pipes in three sections has been carried out at a cost of above $150,000. As to the pipes, it may be observed that they are usually about 12 ft. in length. They vary in thickness according to the pressure resistance required at various points. They are 2 ft. in diameter and weigh about 1½ tons each.

PHOTOGRAPHIC NOTES.

Intensifying Lantern Slides.—Sometimes, by quick and too short development, the image of a lantern slide will fix out too weak. Various methods for intensification have been recommended, but the latest and simplest is that detailed by Mr. A. R. Dresser in the *Amateur Photographer*, as follows: If any negatives or lantern slides are too thin, they can be brought up to nearly any density by first bleaching with mercury (as usual) and then redevelop them with the hydroquinone developer (in place of ammonia). I find that you can redevelop to nearly any extent. One need not use new developer (unless the image is very thin), as the used developer does very well and saves having to throw it away. I always use this developer for lantern slides, and find it all that can be wished, but for ordinary use it is very slow.

I am not aware that any one has used hydroquinone for intensifying before. For under-exposed negatives it works very well, and so far I have found no stain from using it.

To Obtain Black Prints on Bromide Paper.—Mr. Dresser, in the same journal, says: Develop with ferrous oxalate as usual. Give a short exposure and use a strong developer.

After developing wash with acetic acid water, then well wash and pour over the print a solution of mercury (sat. sol. bichloride mercury 1 part, water 3 parts). The image will gradually fade away. When it has nearly done so, wash it carefully, and pour over a saturated solution of sulphite of soda. When it has reappeared, wash for one minute and then put in the hypo. solution (half saturated), leaving it there for ten minutes. Wash thoroughly. The print, when looked at by daylight, will be a rich brown, but it will dry black and white.

Improved Method of Burning Magnesium Powder.—In the SCIENTIFIC AMERICAN for May 3, 1884, page 275, we give an illustration of a method of burning magnesium powder, in which an alcohol lamp projecting a horizontal flame is held underneath a funnel into which is poured, at the time when it is desired to make the picture, magnesium powder mixed with fine sand. Quite recently this method appears to have been reversed by Mr. William Bishop, who demonstrated the working of his apparatus before a meeting of the North London Photographic Society.

We take from the *Br. Jour. of Photo.* the following description of his lamp:

"A square metallic spirit lamp, having a flat top, is fitted with two wicks, one in front of the other, and separated by two or three inches. Immediately behind this lamp is a short wide-mouthed bottle containing magnesium in powder. Dipping into this powder is a glass tube, the other end being carried up through the cork and bent toward the flames of the spirit lamp, which are in a line with the direction of the blowpipe. A second short piece of tube is passed through the cork, its outer end being connected with the rubber tube of a pneumatic ball. On giving this ball a quick, sharp squeeze, a small quantity of the powder is suddenly ejected from the blowpipe nozzle against the flames, this being attended by a dazzling flash. This is capable of being repeated as long as any of the magnesium powder remains in the bottle.

"Two spirit flames are employed instead of one in order to insure the complete combustion of all of the metallic powder that is ejected.

"From a knowledge of and practical acquaintance with all the systems previously employed for producing the flashing light under the most comfortable and effective conditions, we place this, the latest, at the head of them all. It is free from association with either pyrotechnic compounds or gun cotton. Its portability is such as to leave nothing to be desired. Methylated spirit is so cheap as to amount practically to nothing when being occasionally used, and a pinch of a small rubber ball forms the whole means by which the light is started into action over and over again."

It will be noticed from the above description that the appearance of this apparatus is somewhat like the ordinary atomizers which are now in use. Pressure on the bulb forces a fine horizontal stream of magnesium powder directly through two flames of alcohol placed one behind the other. The apparatus is very simple, and undoubtedly will be of much service in photographing interiors and in making portraits by night.

Improved Pyro Developer for Lantern Slides.—Mr. John G. Cassebaum, in the *American Journal of Photography*, relates his experience with an improved pyro. developer, which is particularly recommended for its excellent keeping qualities and for the remarkable clearness of the shadows and brilliancy of high lights it produces in a transparency or lantern slide.

The formula stands as follows:

a	Hydroxylamine	60 grains.
	Pyrogallol	1 ounces.
	Water	6 "
b	Carbonate of soda	1½ ounces.
	Sulphite of soda (crystals)	4½ "
	Water	60 "

For negatives add 2 to 4 drachms of *a* to 8 ounces of *b*, according to the nature of the subject.

For lantern slides, in which too much density should be avoided, 1½ drachms of *a* or the pyro. will be sufficient.

The use of hydroxylamine, as far as my experience goes, communicates virtues which are greatly to be desired.

There is obtained by its use a depth of bluish black tones, rich in gradations, soft and pleasing to the eye, which are not lost when the image is projected upon the screen.

I prefer the hydroxylamine and pyro. development to the ferrous oxalate, not only for the increased beauty of the tones, but also for the degree of intensity obtained without danger of clogging the shadows or making too dense the high lights. The process of development can be watched more readily and the proper degree of strength determined much better than with oxalate. I have a mixture of the hydroxylamine and pyro. which I have kept for more than two months without the slightest indication of discoloration.

Prevention of Blisters on Albumen Paper.—Mr. Ellerslie Wallace, in the same journal, says that the chief cause of blisters is the extreme dryness of the paper at the time it is silvered. The paper, prior to silvering, should be stored in a damp place, like a cellar, or in a dampened room, so that the albumenized sheets will become somewhat limp, or will refuse to curl up when laid out flat on a table. After fixing, the prints should be at once immersed in a solution of common salt, about the same strength as the fixing bath. It is also advisable to gradually dilute the salt solution after the prints have been soaking some minutes.

The Great Bear Valley Dam.

Leaving the small settlement of Crafton, we wind through the Mill Creek canon, and then climb over the San Bernardino Mountain at an elevation of 5,600 feet above the sea, or 4,100 feet above Redlands. Then we go down and through the Santa Anna Valley and cross the next ridge at an elevation of 7,600 feet. Then we descend 1,200 feet and ride three miles further, when we come to the great Bear Valley Dam, which backs up the Bear Valley Lake or great reservoir, as it may now be called. One is spellbound when he examines this stupendous piece of work and realizes the labor that it cost. All of the cement and other materials, excepting the granite, which was quarried near by, was carried by teams and pack mules 100 miles, and each barrel of cement cost $13 when delivered at the dam. It took a team two weeks to reach the Colton Railroad station, and the engineers and laborers lived in rudely constructed log huts for six months. From Colton the route was up the Cajou Pass, thence over the Mojave Desert, then through "Lucky" Baldwin's silver mine trail to the end of the dam. The dam is built of big blocks of granite, ranging from a half ton to ten tons in weight, the majority being about four tons weight each. Its base rests upon a solid rock foundation and its present height is about sixty feet, though it may be increased twenty feet without any risk of weakness. It is a curved dam, its length of arc being 300 feet and its radius 345 feet. Its base is twenty feet wide, and from this it slopes to three feet wide at the top. Its average coefficient of safety is 25, and it would stand twenty times its present pressure. The engineer was F. E. Brown, a graduate of Yale College and of Yale Scientific School, and one of the largest property owners in the county. The State engineer of California has pronounced the work not only efficient, but a remarkable piece of engineering.

The lake or reservoir receives the drainage of 200 square miles. It covers an area of 4,000 acres, three fourths of which around the old lake was used as a sheep ranch until purchased by the Bear Valley Company. At the present height of water, fifty-three feet, at the dam there is a supply of nearly 10,000,000,000 gallons, covering an area five miles in length and a half mile in width an average depth of fifteen feet. With the dam at its full contemplated height the lake will hold 40,000,000,000 gallons, and at sixty-five feet 21,000,000,000 gallons. Before the dam was built this water was allowed to flow in winter torrents to the sea. It is now capable of irrigating 50,000 acres of land in the frostless foothills, once supposed to be beyond the pale of irrigation, and to supply a population of 500,000 for domestic purposes. It at present irrigates the lands included in the towns of Redlands, Lugonia, Crafton, and Highlands, and is to be extended to San Bernardino.

THE Travelers Insurance Company, of Hartford, has just issued its twenty-fourth statement, which shows a gratifying increase in the amount of business, both in the life and accident departments. Nearly $7,500,000 of new life insurance was written, or double the amount it was doing four years ago. Its claim payments amounted to $1,392,000, the greatest in any year since its organization. The accident department shows an increase of over 3,000 policies over 1886, and the increase in volume of premiums much heavier still. This company has the reputation of liberal dealing that entitles it to the large share of public confidence it possesses.

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IRON WORKS OF THE SYRACUSE MALLEABLE IRON COMPANY.

(*Continued from first page.*)

are received and are bedded in the green moulding sand which is contained in snap flasks. The latter are boxes that are secured together by detachable fastenings at the corners. The models are of a peculiar type, as they generally represent small articles. A single sheet will often contain a number of small models separated by gateways. The models are frequently made of metal and are embedded in the sand, the latter being rammed around them while contained in the snap flask. The model is removed, and the whole is then transferred to the floor where the casting is to be executed. The sides of the flask are separated, and the mould is left standing by its own consistency, the wooden bottom board, however, not being removed. This effects a great economy in flasks, but the full number of bottom boards have to be used. The moulders can be seen surrounded by piles of these boards, while on the floor the moulds with the flasks removed are standing. The furnace is tapped, and a long row of workmen with ladles stand in line to catch the metal. The ladles are made of iron, and hold from 35 to 40 pounds of melted iron. They are lined with sand, to prevent the ladles from being perforated. On an average, each ladleful can fill five flasks. The iron used, it should be observed, is charcoal pig. Before pouring the mould a cast iron weight is placed on its top, through whose center is a hole corresponding with the apertures in the mould. This holds the sand down against the hydrostatic pressure of the melted metal during the filling. Owing to the quality of the iron employed, these castings, when finished, are as hard as glass and nearly as brittle. If dropped on a stone floor or iron slab, they would break.

After cooling, the articles are removed from the moulds and taken to the annealing department. Here they have to be treated to heat in the presence of oxide of iron. The effect of this process is to gradually decrease the percentage of carbon by the oxidizing action of the cementing material, so as to ultimately reduce the brittle casting to the condition and toughness of wrought iron. If necessary, the castings are first chipped, so as to remove all fins, gates, etc., before being delivered to the annealers. By the annealers they are packed away in iron vessels called pots, and as fast as they are stored away in these, rolling mill scale is shoveled in among them, the object being to lay them in even layers without touching, so as to have each piece completely surrounded by scale. The pots are 18 × 22 inches in area and 16 inches deep. They are stacked three and four high and are luted with clay at the joints, and clay and sand are placed on top of them.

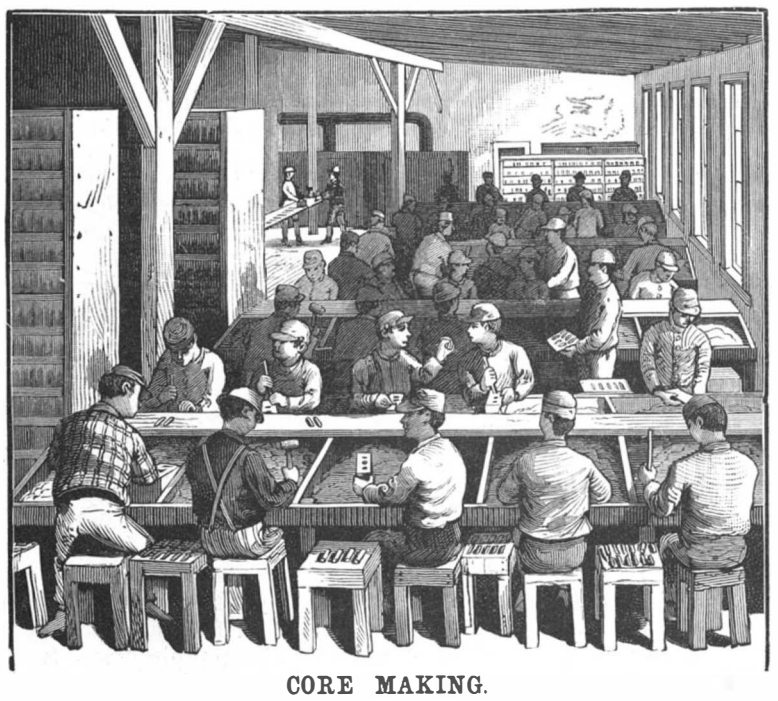
In this way pot after pot is stored full, and they are placed on top of one another to the height of four tiers. These are then taken up on a suitable truck, which is seen in the background of the cut, and are rolled into the kiln. These pots deteriorate very quickly, and part of the work of the foundry is devoted to the manufacture of the same. The iron for these, as it need not be of pure quality, is melted in a cupola furnace, which can be seen on the right hand of the foundry. The annealing kiln is filled with these pots. It can hold from 64 to 140, according to the size, averaging from 6 to 12 tons of castings for the small kilns and as high as 18 for the large. The firing then commences. For four days the pots are exposed to a red heat, and for two days the kilns are allowed to cool, then the pots are removed and their contents discharged on the floor. The castings are removed from the scale and are ready for cleaning by the tumbling process. The scale is placed to one side. In each annealing process the oxygen of the scale is, of course, exhausted. In order to regenerate it a solution of sal ammoniac is sprinkled upon it. This reoxidizes it and brings it again to the condition of peroxide. The tumbling department contains a series of cylindrical vessels which are kept rotating. These are charged with castings, and by their rotation the objects are perfectly cleaned. The tumbling process is executed dry.

A very characteristic department is the core making room. For such small objects which have to be cast in such large quantities, an enormous quantity of cores are naturally required. They are manufactured in moulds by boys, and as fast as they are dried in the kilns—which can be seen in the back of the core-making room—they are stored away in racks to one side. For every casting which includes a perforation a core is, of course, used, and this gives some clew to the immense number which are required for such an establishment.

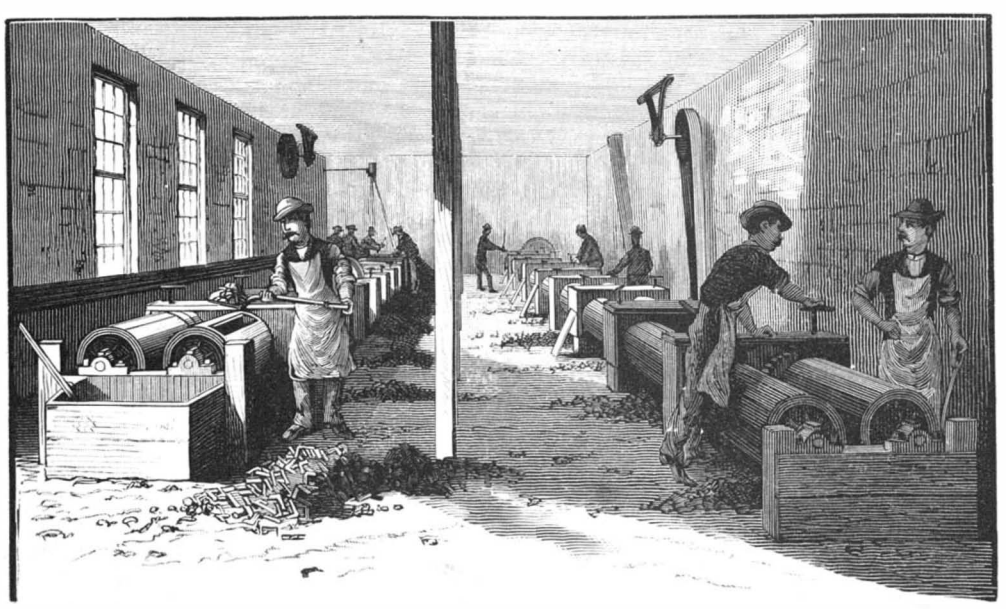
The works were started by W. B. Burns, in 1882, and are still under his proprietorship. Mr. A. W. Dowsland is the superintendent. The work is generally skilled labor, such as pattern making, moulding, and the like.

The castings made in these works vary in weight from one-half pound to three hundred pounds. They are generally shipped in barrels, as these are more conveniently moved than square boxes. Each barrel holds from 100 to 800 pounds.

The works annually consume 3,000 tons of coal and 15,000 fire brick are used every year. Of the forge cinders but little is required each year, as they are used over and over again.



CORE MAKING.



THE TUMBLING DEPARTMENT.

Washable Walls in Cottages.

E. Chadwick, in the *Architect* (London), says: As a principle, all interior cottage walls should be made washable. Besides the evil arising from absorbency of the animalized gases of walls of the common construction, there is another great source of evil attaching to walls of the common soft stone construction—the absorbency and retentiveness of water or damp. In England the common bricks absorb as much as a pint or a pound of water. Supposing the external walls of an ordinary cottage to be one brick thick, and to consist of 12,000 bricks, they will be capable of holding 1,500 gallons, or 6½ tons of water. To evaporate this amount of water would require nearly a ton of coal, well applied. The softer and more workable stones are of various degrees of absorbency, and appear to be more retentive of moisture than common brick.

Professor Ansted states that the facility with which sandstone absorbs water is illustrated by the quantity it contains both in its ordinary state and when saturated. He states that even granite always contains a certain percentage of water, and in the dry state is rarely without a pint and a half in every cubic foot. Sandstone, however, even that deemed fit for building purposes, may contain half a gallon per cubic foot, and loose sands at least two gallons. When water presents itself in any part of such material, it readily diffuses itself by the power of capillary attraction, by which, it is observed on some walls in Paris, it ascends 32 feet from the foundations. Walls of such absorbent constructions are subject to rising wet by capillary attraction, as well as to the driving wet of rain or storm. To guard against the driving wet on the coast expensive external coverings of slate are used. But these do not stay the rising wet. This wet, having to be evaporated, lowers temperature. Damp walls of houses cause rheumatism, lower strength, and expose the system to other passing causes of disease.

In London it is admitted that houses, even of the better class, cannot safely be inhabited in less than nine months. Indeed, registrars of deaths are aware that an extra death rate is, after all, usually attendant on their first occupation. The majority of bent figures in our villages are due to the infliction of rheumatism from damp.

In Paris, notwithstanding its peculiarly dry subsoil and its drier climate, the sanitary, or insanitary, evils of the common architect's constructions appear to be even greater than in London. I was assured by a Parisian builder of considerable experience that it was unsafe to occupy any new house in Paris in less than a year after its construction, and that there were houses in Paris which would never be dry "in their lives," and would always afflict their occupants.

Electrical Attraction of Quartz.

BY ALEX. HODGKINSON, M.B., B.SC.

Quartz, like most other substances, becomes electrified by friction, and also possesses the property of remaining in an electrified condition for a period varying from ten minues to half an hour after the friction has ceased. When this medium is used as a cover for compasses, this electrical property may manifest itself in such a marked manner as to render the readings of the instrument utterly unreliable, and more especially is this the case where the instrument is provided with a quartz cover back and front. In the compass exhibited the back and front of the instrument consist of two plano-convex lenses of quartz with their plane surfaces toward each other, the needle rotating between these covers on an axis, the extremities of which fit into two conical holes in the center of the quartz covers. In the case of this instrument the mere act of removing it from the warm pocket is usually sufficient to cause the needle to assume a fixed position in relation to the compass itself, and quite unaffected by the magnetic attraction of the earth. If, while in this condition, the instrument is rotated, the needle also rotates as if a fixture. If the surface of the quartz be rubbed with the dry finger in a radial direction, the needle at once takes up a position in the same direction, and if compelled by shaking to change its position, it resumes it when allowed to remain at rest. When the compass is so turned that the axis of the needle is in the direction of the magnetic force of the earth, and the needle therefore in equilibrium, the effects of radial friction become still more marked. As might be expected, the property is not confined to quartz. A compass covered with glass exhibited the same phenomena, with the important difference that in this case the attractive influence ceased with cessation of the friction. That the attractive influence is quite independent of the magnetic force of the needle is proved by the fact that an instrument similar in every respect to the first mentioned instrument, excepting that the needle was left unmagnetized, exhibited the same phenomena. The action is thus one of simple electrical attraction.

Fireproof Building Material.

The *Real Estate Record* says that fire ruins show that porous terra cotta bricks and blocks best resist fire, water, and frost. Next to these in the order of fire resisting qualities come concretes and burned clay work. In the best work done, the iron work is incased in porous terra cotta, tile, or brick work in roof, floor, and tile construction. The hollow tiles are faced with vitreous tile, slate, or any good weatherproof coating, or with a single thickness of brick. Iron and steel framework incased in fireproof materials gives the best possible results. There is a growing preference for light porous walls of hollow material protecting an iron or wooden framework. Massive and heavy walls of brick or stone will do for architecture, but they are not as much of a mechanical necessity as they were regarded a few years ago.

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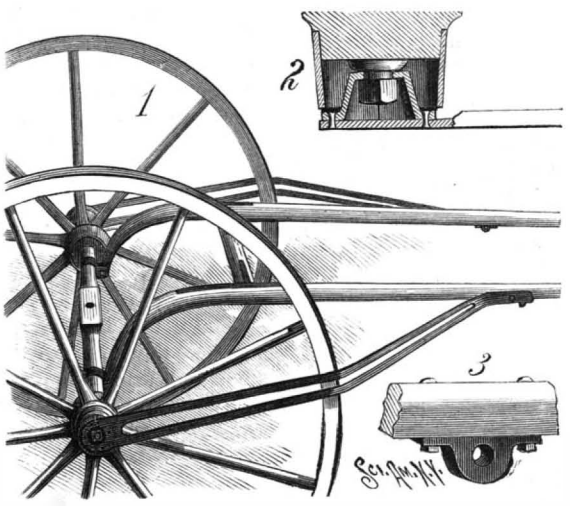
A GUARD RAIL FOR VEHICLE WHEELS.

A device to be attached to the thill and axle of a buggy or other vehicle, not to interfere with the free turning of the wheel, to prevent damage from collision with other vehicles by the wheels becoming interlocked, has been patented by Mr. John C. Tatman, of Mount Vernon, Dakota Ter., and is illustrated herewith, Fig. 2 showing a horizontal sectional view of a portion of

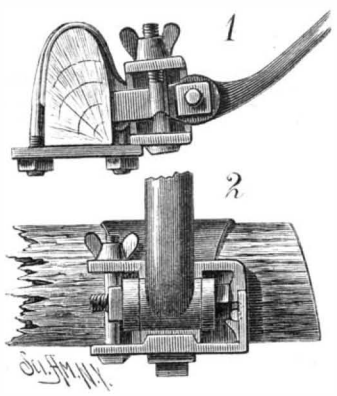


TATMAN'S GUARD RAIL FOR VEHICLE WHEELS.

the axle with the guard rail in place thereon, and Fig. 3 a view of the thill attachment. The guard rail has a circular opening in its rear end, behind which is a hollow or cup-shaped boss, adapted to fit upon the usual screw-threaded spindle of the axle. The guard rail thence extends forward and slightly inward, with a gradual sweep to a suitable point on the thill, where, through a transverse hole in its end, it is bolted by a pin to a drilled lug or web upon the under side of the thill. This guard rail not only precludes danger of the wheel becoming injured by collision or interlocking, but braces and strengthens the vehicle.

AN IMPROVED THILL COUPLING.

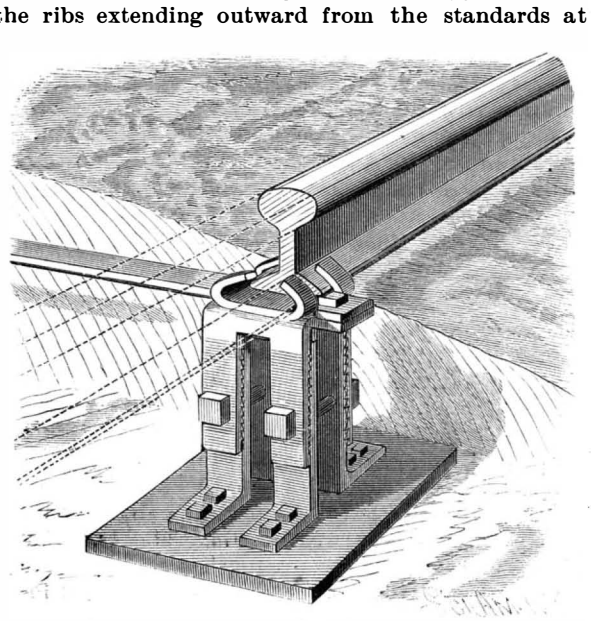
A simple and inexpensive thill coupling, designed to prevent rattling and be durable, is illustrated herewith, and has been patented by Messrs. Henry and John Knupp, of Warren, Pa. Fig. 1 shows a side view in section and Fig. 2 a front view, there being combined with the pivoted thill iron an elastic or compressible anti-rattler, placed next the thill iron eye. A clamp comprising opposite plates, hinged together at one side, bears upon the anti-rattler, and a screw passing through the opposite plates holds it in position. One of the clamp plates has a lug overlying the head of the thill iron pivot, and all the parts are cheaply and easily made, though forming a most efficient coupling.



KNUPP'S THILL COUPLING.

A COMBINED RAILWAY RAIL CHAIR AND TIE.

A railway rail support that is designed to be durable, stable, adjustable, elastic, and economical is illustrated herewith, and has been patented by Mr. Nicholas M. Marks, of Quanah, Texas. The base plate has its edges turned down to form flanges, and to the upper face of this foundation seat are secured four upwardly extending standards, in the form of angle irons, the outer faces of the standards being ribbed, the upper faces of the ribs extending outward from the standards at about right angles. To these standards are connected a rail support, formed from a blank having a central section with apertures, with arms bent down to extend at right angles from the central section, the space between the arms being such as to freely admit the standards, the arrangement being such that the rail support may be adjusted toward or from the base to such position as may be required to bring the rail to a proper level. Two such supports are connected by a cross bar, the ends of which are wider than its main portion, in such way as to make an exceedingly firm connection between the parts, but so that a proper adjustment of the supports and the parts by which they are carried may be readily made. The construction is such that the foundation, once in place, need not afterward be disturbed, but vertical and lateral adjustments can be easily effected.



MARKS' RAILWAY CHAIR AND TIE.

Magnesium in Electric Batteries.

M. Heim, of Hanover, has lately made a series of observations on the increased electromotive force obtained by substituting magnesium for zinc in various well known cells. As anticipated, from the known fact that the heat of combination of magnesium with oxygen is greater than that liberated on the oxidation of zinc, the electromotive force of the cells in which the substitution was made experienced in every case a notable increase. Thus the electromotive force of a Daniell cell, the positive electrode of which was a copper plate immersed in a solution of sulphate of copper, was measured, first, when the negative electrode was a zinc rod plunged in dilute sulphuric acid; secondly, when a magnesium plate was substituted for the zinc, the solution remaining unchanged; and, thirdly, with a magnesium electrode in a solution of magnesium sulphate, and under these conditions the following figures were obtained: 1·185 volts, 2·033 volts, and 1 93 volts—results which were very favorable to magnesium. Nearly as striking figures were obtained in making the charge in a Bunsen cell, the positive electrode of which was a rod of arc lamp carbon. In this case, using both metals under similar conditions, the electromotive force was 22 per cent greater with the magnesium than with the zinc plate. With a Leclanche cell the electromotive force was raised by the charge from 1·5 volts to 2·3 volts, or upward of 53 per cent. These facts seem to show that considerable advantages would follow the use of magnesium in primary cells generally, if the metal could at any time be produced at a cost approximating to that of zinc.

Preserving Telegraph Poles.

Telegraph poles are preserved in Norway by making an auger hole, about an inch in diameter, in each post, about two feet from the ground, and pointing down at a small angle till the center of the stick is reached. From four to five ounces of sulphate of copper, in coarsely powdered crystals, is inserted, and the opening is stopped with a plug, which projects so that it can be pulled out to admit of replacing the charge every three or four months. The chemical is gradually absorbed by the wood, which, it is said, permeates to the very top of the pole, the whole outside surface assuming a greenish tint, due to the presence of copper in the pores. This simple means of preservation suggests the application of the same material to other purposes than telegraph poles.

The New Gas, Hydride of Nitrogen.

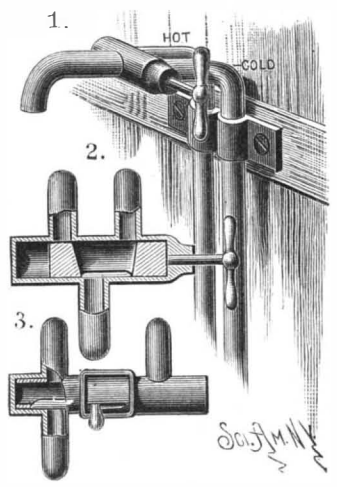
The discovery of a new gas is reported in Germany by Dr. Theodore Curtius, who has succeeded in preparing the long sought hydride of nitrogen, amidogen, diamide, or hydrazine, as it is variously called. This remarkable body, which has hitherto baffled all attempts at isolation, is now shown to be a gas perfectly stable up to a very high temperature, of a peculiar odor—differing from that of ammonia—exceedingly soluble in water, and of basic properties. In composition it is nearly identical with ammonia, both being compounds of nitrogen and hydrogen.

AN IMPROVED MASON'S FLOAT HANDLE.

A handle which may be detached from one float and attached to another in a short space of time, but one tool being required to make the transfer, has been patented by Mr. Edward M. Van Duzer, of No. 98 Thomas Street, Newark, N. J., and is illustrated herewith, in perspective and transverse sections. The handle has the usual grip and standards, with ears integral with the ends extending outward at right angles, the ears being apertured between the ends and the standards. A screw passes loosely through the aperture in each ear, and is provided with a winged lock nut having a centrally rectangular recess to receive the rectangular head of the screw, the nut to act as a wrench or lever to turn the screw. The other end of the screw is flattened and beveled upon opposite sides to form a wide cutting edge, wider than the diameter of the aperture in the ear. This handle can be readily and expeditiously detached from a mason's float that is unfit for use and attached to a new one, or with such handle a new float can be quickly and efficiently made from a rectangular board of suitable size.

AN IMPROVED FAUCET.

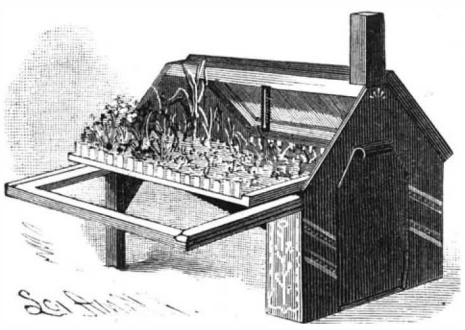
A faucet especially adapted for use with stationary basins, whereby either hot or cold water, or both, may be made to flow from one spout and be controlled by one handle, has been patented by Mr. William B. Rodman, of Norfolk, Va., and is illustrated herewith, Fig. 2 showing a partial vertical and longitudinal section and Fig. 3 a front elevation, partly broken away, of a modified form of faucet. Separate inlets are provided for cold and hot water, with a single outlet upon the opposite side, there being an interior pin near the forward end, and a plug having a reciprocating and rotary motion, provided with an elongated diametrical aperture having tapering ends adapted to register with the inlets, singly or collectively, and with the outlet, there being a segmental peripheral recess adapted to receive the pin. By this device the flow may be increased or diminished as desired, or any wished for proportion of hot or cold water be obtained.



RODMAN'S FAUCET.

AN APPARATUS FOR TESTING SEEDS.

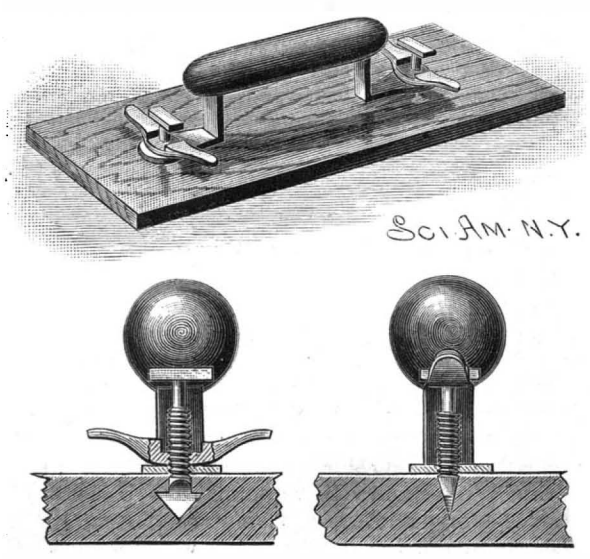
An apparatus for determining the vitality or germinative qualities of seeds, to enable both the dealer and the purchaser to judge more accurately than is ordinarily possible, has been patented by Mr. Henry A. Goetz, of New Albany, Ind., and is illustrated herewith. It has a lamp chamber at one end, and a flue leading therefrom in such way as to diffuse an equable warmth through the compartment in which is located the seed pan. The seeds are placed in the pan on a bedding of cotton or other fibrous material, in rows which are properly labeled, and then water is poured in the pan at one edge of the cotton, so as to float the cotton and the seed placed thereon, the compartment being closed by glazed doors to allow of raising the temperature as desired. The moisture supplied to the seeds at the same time assists the heated air in the chamber in causing the good seeds to sprout, while the operation has little or no effect on poor and worthless seeds.



GOETZ'S SEED TESTER.

Total Eclipse of the Moon.

Our readers must not forget the eclipse of the moon which will occur on January 28, beginning at 5:30 P.M. The full data will be found in our issue of January 7, 1888, page 2, of the present volume, to which we refer for particulars of the different phases. The interest of the phenomenon will be enhanced by the fact that it occurs at so convenient an hour.



VAN DUZER'S MASON'S FLOAT HANDLE.

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Fire Precautions as to Woodworking Shops in Berlin.

The police authorities of Berlin, Prussia, have published the following orders regulating the arrangements where fires are used in woodworking shops in that city. These orders are founded on the building inspection ordinance of January 15, 1887, for Berlin and its environs.

1. The wood shops must have solid principal walls of brick or stone.

2. When there are persons dwelling over woodworking shops, the floors of such dwellings must be fireproof (*feuerfest*), and any wooden floors must have ceiling below piped and plastered, and the plaster covered with corrugated sheet iron.

3. In arrangements for heating woodworking shops during winter, or for drying purposes, no kind of metallic stoves or pipes for the same shall be used. Stoves must be of stone or tiles, and so arranged that they can be supplied with fuel on the outside only of the wookrooms, or in a fireproof projection at last 59 inches in height and 20 inches in depth. Any iron covers which may be upon such stoves must be protected with at least two thicknesses of tiles or slates laid in mortar. For conducting smoke from stoves to chimneys, only flues built in walls shall be used. Woodworking shops having in one or in several rooms a superficial area of 9,700 feet must conform to the following prescribings:

(*a.*) Among dwellings, woodworking shops and the needful storage room therefor shall be permitted only when they are entirely isolated from the dwellings that may be located above them, by fireproof floors (as before stated), and when the dwellings have one or more staircases separated from the workshop by substantial walls.

(*b.*) The stairways to such workshops must be fireproof, and doors leading therefrom to interiors made of iron. Doors must open outward, and be self-closing. Such doors are not to have wooden cases, or other wooden supports.

(*c.*) For each workshop there must be a separate glue heating room, having thick brick walls, ceiling vaulted, and floor and ceiling below of non-inflammable materials. There must be an iron door at the entrance to this room, and between the door, when open, and the heating furnace a distance of at least 20 inches. So-called "glue heaters" are not permitted.

(*d.*) Every workshop must have a separate shavings bin, located in the cellar, or upon solid ground outside—constructed on the four sides of thick walls, vaulted above. This bin must have a separate entrance from the courtyard, closed by an iron or an iron-plated door. —*Assecuranz* (*Vienna*).

The Baku Naphtha Springs.

Although within the last two years intelligence has frequently reached Europe of extraordinary outbursts of mineral oil on the Apsheron peninsula, near Baku, nothing has yet equaled the astonishing outbreak which the Northern Telegraph Agency telegraphed a few days ago. Their telegram was to the effect that near the petroleum works of a certain M. Arafeloff a fountain of oil was throwing out over 2,400 tons daily, that this had been continuing without intermission for four weeks, and that more than the half of this enormous output was going to waste. It is to this loss of the oil that attention is now being directed. Not only at Arafeloff's fountain, but at almost every large fountain in the Balakhan-Sabuntchin district the waste of this most valuable product has been enormous. Millions of pools of oil have been lost, owing to the inefficient way in which it is reservoired and stored. It is now understood that the government will take immediate steps to prevent this ruinous waste and to compel the owners of oil springs to adopt more scientific methods of boring, collecting, and storing.

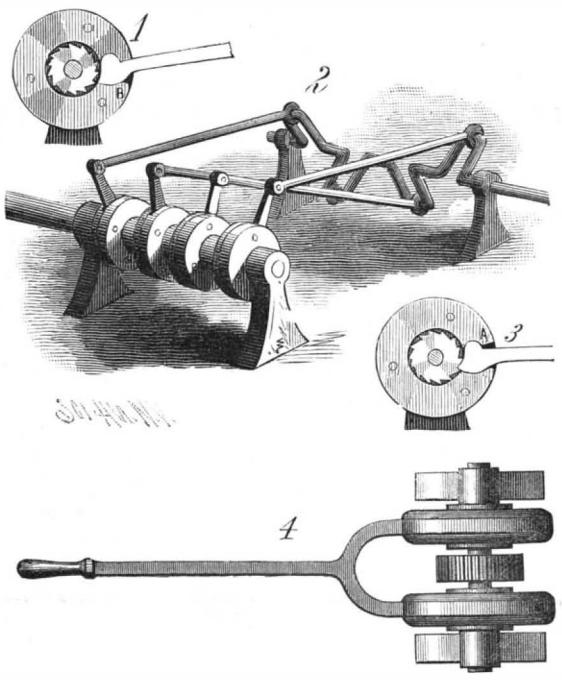
Reciprocal Influence of Sense Organs.

Some interesting experiments on the reciprocal influence of organs of sense have been recently made by Herr Urbanschitsch, of Vienna. His general conclusis, says *Nature*, that any sense excitation has for result an increase of the acuteness of other senses. Thus, sensations of hearing sharpen the visual perceptions. If colored plates are placed at such a distance that one can hardly distinguish the colors, and various sounds are then produced, the colors become generally more distinct the higher the sounds. Similarly, one can, while a sound affects the ear, read words which one could not read before. Again, the ticking of a watch is better heard when the eyes are open than when they are closed. Red and green increase auditive perceptions; but blue and yellow weaken them. Several musicians, however, were agreed that red, green, yellow, and blue caused an intensification of sound about one-eighth; while violet had a weakening effect. Taste, smell, and touch are under like laws. Light, and red and green color, increase their delicacy; while darkness, blue, and yellow diminish it. Under the influence of red and green, taste extends from the anterior border of the tongue to the whole surface. On the other hand, a strengthening of smell, taste, or touch exalts the other sensitive perceptions. Specially interesting is the reciprocal influence of touch and the sense of temperature. If one tickle the skin with a hair, and plunge the hand in hot water, the tickling sensation ceases; on the contrary, if the hand be placed in cold water, and a part of the body tickled, the temperature is felt more vividly. Herr Urbanschitsch finds in this reciprocal action an explanation of supposed double consecutive sensations on excitation of one sense.

AN IMPROVED RATCHET AND LEVER MECHANISM.

A device, consisting of a ratchet sleeve or teeth held on a shaft and operated upon by one or more ratchet levers, with a pawl held in a ring or carrier through which the ratchet sleeve passes loosely, has been patented by Mr. John Bayet, of O'Fallon, St. Clair County, Ill., and is illustrated herewith, Figs. 1 and 3 showing sectional views of the carrier and pawl, and Fig. 4 a plan view of a modified form of the improvement.

The shaft carries one or more ratchet sleeves, or the teeth of the ratchet may be directly cut on the shaft, a lever or pawl being provided with a head, which has its bearing in a recess formed in a carrier having a removable front plate, so that the head of the lever can



BAYET'S RATCHET AND LEVER MECHANISM.

easily be placed in the recess. On the head of the lever is a semicircular projection which is the fulcrum of the lever, and on the head is also formed a jaw adapted to engage or disengage the teeth of the ratchet sleeve. The motion of the ratchet lever is limited by the peculiar shape of the recess, so that it is practicable to impart a partial rotary motion or a continuous rotary motion to the shaft, increasing at the same time the power of the latter. The number of levers and ratchet sleeves can be varied according to the work to be done, and the length of the levers is determined according to the space in which they are to be used or the amount of power they have to communicate.

The device is applicable to a wide variety of shop machinery, and may also be used in running thrashing machines and for other purposes.

Effect of the Atmosphere on Bricks.

Atmospheric influence upon bricks, tiles, and other building materials obtained by the burning of plastic clays depends very much on the chemical composition of the clays and on the degree of burning. Thus any distinct portions of limestone present in them would be converted into quicklime in the kiln, and when the bricks were thoroughly wetted would expand in such a manner as to disintegrate the mass. If the clay used is too poor—that is to say, if it contains an excess of sand—the bricks will not become sufficiently fused, and upon exposure to the weather their constituent parts will separate. It is to be observed that in bricks, as in stones, decomposition does not take place with the greatest rapidity where constant moisture exists, but rather where, from the absence of capillarity, variable according to the moisture furnished by the atmosphere, either directly or indirectly, a series of alternations of dryness and humidity prevail.

The foundation walls of buildings do not in fact suffer so much in the parts immediately upon the ground as they do in those at a height of from one to three feet, according to the permeability of the materials employed. When bricks made of clay containing free silica are laid in mortar, and moisture can pass freely from either one or the other, it may be observed that the edges in contact become harder than the body of the bricks. No doubt this arises from the formation of a silicate of lime and alumina, the lime being furnished by the passage of the water through the bed of mortar.—*G. R. Burnell, in the Architect* (*London*).

The German Corn Laws.

The German Reichstag has, after a long and extremely animated discussion, in which the Free Trade party made its influence strongly felt, raised the import duty on cereals, in response, says *Industries*, partly to the clamor of the agriculturists for further protection, and partly in satisfaction of a revengeful feeling evoked by the fiscal policy of Russia toward Germany. The annual consumption for the whole of the German empire has now reached, in round numbers, 400,000,000 cwt. Down to the year 1866, the home production exceeded the requirements, but since that date an important import trade has sprung up, and has grown so rapidly that German agriculturists have been driven into adverse circumstances.

In the period between the years 1881 and 1884, inclusively, the imports of cereals, about one-half of which were derived from Russia, increased, on an average, by 40,000,000 cwt. annually, or about one-tenth of the total consumption. As the tendency of this foreign trade manifestly was to grow at a still more rapid rate, the agricultural party became alarmed at the prospect, and raised an outcry against the insufficiency of the existing tariff laws. Pressure was brought to bear upon the government to raise the duty on wheat to 3s. per cwt. The result is not quite up to this high level, but the compromise that has been effected between the extreme and the moderate parties fixes the duty henceforward at 2s. 6d. Under these amended laws, Germany has the highest import duties for cereals of any country in Europe. The following is a comparative table of the rates now in force per cwt.:

	Wheat. s. d.	Rye. s. d.	Barley. s. d.	Oats. s. d.
Germany	2 6	2 6	1 1·5	2 0
France	2 0	0 7·3	0 7·3	1 2·6
Spain	1 9	1 3·5	1 3·5	1 3·5
Austria	1 6	1 6	0 9	0 9
Italy	1 2·6	1 2·6	0 5·6	0 9·7

The Sewers of Paris.

The idea of a pleasure excursion through a sewer must seem to a denizen of any of our large cities, who has never visited Paris, a most singular event.

A visit to the catacombs which extend under a large section of the city, and an excursion through the sewers, which a correspondent of a Chicago paper very faithfully describes, affords to strangers probably as much interest as anything they will see in the great French metropolis.

We started, says the writer, from the Palace Chatelet at three o'clock, and descended a little winding staircase, the steps and walls of which were covered with a green cloth fringed by a red border. There was not the slightest danger of soiling our clothes or of encountering the least disagreeable odor. On arriving at the foot of the stairs a fine display of fruits and vegetables was the first thing to greet our eyes. These products were from Gennevilliers, and were grown in gardens that are watered by the sewers. We got into a wagon in which were seats for twenty persons. Off we went, shoved along by solid-looking fellows, all neatly dressed. Above us was a mass of tubes and pipes. They are the water pipes, the two largest containing our drinking water from the Vanne and the water from the Ourcq, which latter is used for washing the streets and sidewalks. Then there were the pneumatic tubes, in which we could hear the rattle of the dispatch boxes.

Soon we reached the crossing of the Pont Neuf. This tunnel was lighted from end to end with garlands of colored lamps. The effect was fairy-like. The same effect was produced under the Rue de Louvre, the Rue de Richelieu, and the Place des Pyramides, where precisely under the statue of Joan of Arc appeared in luminous glass the arms of the city of Paris. We passed along, still following the Rue de Rivoli, where each house has its number in the sewer, just as in the street, until we reached the Place de la Concorde. There the electric lights, crossing the fires with the reflection of the Venetian lamps, turn the square into a sort of ball room. Nothing was wanting, not even music. We all got out of the wagons to embark in boats, furnished with cushioned seats. The music was in the first boat, which was decorated with flags and lamps. The boats were started. We followed the entire route of the Rue Royale by the light of fifty dazzling electric lamps. After a quarter of an hour in this boat we landed at the foot of a staircase, which we mounted, and in three minutes we were above the ground at the Madeleine.

THE Billings & Spencer Co., of Hartford, are using from two to three tons of copper monthly in making drop-forged commutator bars and segments for electric generators and motors. Among the electric light companies for whom they are furnishing this line are the Edison, Thomson-Houston, Westinghouse, Waterhouse, Fort Wayne, Jenney, Electro-Dynamic, Richter, and Western. They have recently brought out carbon tongs for handling the carbons in arc lights, which are being largely used, and are furnishing drop-forged eye bolts in ten sizes, from three-eighths up to and including two inches diameter of shank.

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Correspondence.

Preservation of Iron.

To the Editor of the Scientific American:

The author of the article entitled "The Preservation of Iron and Steel Ships" (which appears in the SCIENTIFIC AMERICAN of December 17, credited to the *Engineer*), in the course of his remarks upon oxidation of iron (and steel), says: "Oxidation engenders further oxidation. Hence the necessity of frequently scaling the surface of iron which is permitted to oxidize at all."

The old-time shipmasters were aware of the fact mentioned in the foregoing quotation. Witness the ancient doggerel, descriptive of a sailor's duties: "Six days shalt thou work, and do all that thou art able; and on the *seventh*, scrape the anchor and pound the cable." J. M. G.

Dumb Bell Therapeutics.

To the Editor of the Scientific American:

In your issue of January 7, you refer to Dr. Sohli's favorite prescription for habitual constipation. Dose for an adult, one 4 lb. cannon ball to be rolled about upon the abdomen in the morning, say 5 or 10 minutes, or until it produces the desired effect. This is better than medicine, but cannon balls are not easily procured.

Hence, I would suggest that a dumb bell will serve as well or better, and can be obtained at any hardware store. And the dumb bell gets in more work, because, having two butt ends, it kneads in two places at once. Should weigh 6 to 8 lb. The dumb bell—the great blood purifier, mental stimulant, and moral restorative—also gets other exercise out of the man, because he is often tempted to pick it up and go through the dumb bell motions. S. N. STEWART.

Philadelphia, January, 1888.

Prof. Swenson's Sugar Patent.

To the Editor of the Scientific American:

If patent No. 371,528 was granted to Prof. Swenson for the device of neutralizing the organic acids in the juice of the sorghum plant with lime, it might possibly be revoked on other grounds than those mentioned in the United States Senate the other day.

As early as the summer of 1881, H. A. Weber and M. A. Scovell, professors of chemistry at the Illinois State University, made substantially the same discovery, and during the years 1882–83 superintended the construction of factories at Champaign and Hoopston, Ill., and at Sterling, Kan.

The writer was engaged at the Champaign factory in neutralizing the juice, and knows whereof he speaks. The juice was pumped to tanks in the upper part of the factory, where it was treated with sufficient lime water to exactly neutralize the acids present, the tests being made with litmus paper. The invention was a decided success, and several hundred barrels of sugar were produced from each of the factories. The article produced was nearly pure sucrose, and sold readily as C sugar. The reduction of the tariff, however, so reduced the price as to render the business unprofitable, and all the factories were closed.

In the Weber-Scovell process the juice was removed from the cane by means of crushers, but whether this fact has any bearing on the question of priority of invention I know not. Certain it is that the Weber-Scovell process was much discussed at the time, and one man came all the way from Russia to learn it.

H. P. LITTLE.

Sadorus, Ill., January 3, 1888.

[Prof. Swenson's patent, as we understand it, covers the use of lime in the diffusion baths. If this is not original with him, the patent would fall. The use of lime for correcting the acidity of expressed juice has long been practiced, and this is not claimed by Prof. Swenson.—ED.]

Use of Lime to Neutralize Sorghum Juice.

To the Editor of the Scientific American:

I read in the SCIENTIFIC AMERICAN of December 31, 1887, an article on Prof. Swenson's patent for neutralizing the acid in sorghum cane juice by the use of lime, Have also read numerous articles in different papers on the same subject, but have looked in vain for the statement of a fact which I should think would have found its way into the papers before this. The fact is this, namely, that Prof. Swenson is not the first to use lime to neutralize the sorghum juice. Lime was used for this purpose by Profs. Weber and Scovell at the Champaign (Ill.) sugar factory in 1882, and again by Prof. Scovell at Sterling, Kan., during the fall of 1883. I was night engineer in the Sterling factory, and know whereof I speak.

My recollection is that Profs. Weber and Scovell secured a patent on this very idea of using lime. At any rate, they took out some patent for making sugar from sorghum, and for that reason their connection with the State University at Champaign was severed.

It was quite a surprise to me to learn that Prof. Swenson had patented this five-year-old idea. I think a little investigation will show that it is valueless, to him as least.

Prof. Weber is now professor of chemistry at the Ohio State University, Columbus, O., and Prof. Scovell occupies a similar position at Nashville, Tenn., I think. A correspondence with either of them will develop whether I am mistaken about their patent covering the ground claimed by Prof. Swenson or not.

About their *using* lime to neutralize the acid in the juice I am positive, for I have seen it done many times. The juice was always tested afterward with litmus paper.

Whether Profs. Weber and Scovell's patent did or did not cover the use of lime, they and a number of others can testify that they used it long before Prof. Swenson, though not on diffusion juice. But would that make any difference?

I trust that my statement may interest you sufficiently to investigate, and see if I am not right in surmising that Prof. Swenson's patent is invalid.

C. N. ROBERTS.

Jefferson, Cook County, Ill.

[In Professor Swenson's patent, the claim covers the use of lime with the chips in the diffusion bath. If this is not new, the claim falls. As we understand the patent, no claim is made for the broad or general idea of neutralizing sorghum juice with lime.—EDS.]

Six Years' Labor Troubles.

The Boston *Herald* presents the following abstract of Commissioner Carroll D. Wright's third annual report of the Bureau of Labor, which relates entirely to strikes and lockouts for the period of six years ending December 31, 1886. It gives the result of the first general investigation ever made by any nation of the facts concerning strikes and lockouts for any extended period or for any wide extent of territory. The report covers about seven hundred printed pages, and gives the details of each strike and lockout occurring in the United States during the period named. It exhibits the facts belonging to each industrial disturbance for each locality where trouble was found, without attempting to establish or decide upon the connection between them. The following table shows the number of strikes occurring during each of the last six years, the number of establishments involved, and the average number of establishments involved in each strike:

Years.	Strikes.	Establishments involved.	Average no. of establishments involved in each strike.
1881	471	2,928	6·2
1882	454	2,105	4·6
1883	478	2,759	5·8
1884	443	2,367	5·3
1885	645	2,284	3·5
1886	1,412	9,893	7
Totals	3,903	22,336	5·7

In 1887 there were, according to the best information obtainable, 853 strikes, details of which are not available. The report shows that during the six years covered by the investigation, New York had the largest number of establishments affected both by strikes and lockouts, there being for the former 9,247 and for the latter 1,528.

The building trades furnished 6,060 of the total number of establishments engaged in strikes. The total number of employes involved in the whole number of strikes for the entire period is shown to have been 1,318,624. The number of employes originating the strikes was 1,020,832. The number of employes in all establishments before the strikes occurred was 1,662,045, while the whole number employed in the establishments involved after the strikes occurred was 1,636,247—a loss of 25,798. There were 103,038 new employes engaged after the strikes, and 37,483 were brought from other places than those in which the strikes occurred.

In 2,182 establishments lockouts were ordered during the period named. In these there were 173,995 employes before the lockouts occurred and 169,436 after, while the number actually locked out was 159,548. There were 13,976 new employes secured at the close of the lockouts, and 5,682 were brought from other places than those in which the lockouts occurred.

"It should be remembered, however," says the report, "that these figures do not represent the actual number of individual establishments or different employes engaged, as in many cases there have been two or more strikes or lockouts affecting the same establishment in the same year. In such cases the establishments and the number of employes engaged are duplicated."

Of the whole number of employes involved in strikes during the six years, 88·56 per cent were males and 11·44 per cent females. Of those in lockouts during the same period, 68·78 per cent were males and 31·22 per cent females.

An examination of the tables appended to the report shows that New York, Pennsylvania, Massachusetts, Ohio, and Illinois represent 74·74 per cent of the whole number of establishments affected by strikes throughout the country and 90·80 per cent of the lockouts. These five States, it is stated, contain 49 per cent of all the manufacturing establishments, and employ 58 per cent of the capital invested in mechanical industries in the United States. Of the 22,336 establishments in which strikes occurred, in 18,342, or 82·12 per cent of the whole, strikes were ordered by labor organizations, while of the 2,182 establishments in which lockouts occurred, 1,753, or 80·34 per cent, were ordered by combinations of managers. Of the whole number of establishments temporarily closed for business, 13,443, or 60·19 per cent, were on account of strikes; on account of lockouts, 62·60 per cent. The average duration of stoppage on account of strikes was 23·1 days, and for lockouts 28 days.

The results of the strikes, so far as gaining the objects sought are concerned, are shown to be as follows: Success followed in 10,407 cases, or 46·59 per cent of the whole; partial success in 3,004, or 13·45 per cent of the whole; and failure followed in 8,910 cases, or 39·89 per cent of the whole. By lockouts, 564 establishments, or 25·85 per cent of the whole, succeeded in gaining their point; 190, or 8·71 per cent, partly succeeded; and 1,305, or 59·80 per cent, failed.

As to the causes or objects of strikes, it is shown that increase of wages was the principal one, 42·44 per cent. The other leading causes are given as follows: For reduction of hours, 19·45 per cent; against reduction of wages, 7·75 per cent; for increase of wages and reduction of hours, 7·67 per cent; against increase of hours, 62 per cent. Total for the five leading causes, 77·83 per cent. All other causes, 22·17 per cent.

Disclaiming absolute accuracy, the report gives the losses of employes and employers resulting from strikes and lockouts as follows: Losses to strikers during the six years, $51,816,165; loss to employes through lockouts for the same period, $8,132,717, or a total wage loss to employes of $59,948,882. This loss occurred for both strikes and lockouts in 24,518 establishments, or an average loss of $3,445 to each establishment, or nearly $40 to each striker involved. The assistance given to strikers for the same period, as far as ascertainable, amounted to $3,325,057; to those suffering from lockouts, $1,105,538, or a total of $4,430,595. These amounts, however, the Commissioner says, are undoubtedly too low.

The employers' losses through strikes for the six years amounted to $30,732,653; through lockouts, $3,432,261; or a total loss to the establishments involved of $34,164,914.

The tables also show that the chief burden of strikes was borne by 13 industries, viz.: Boots and shoes, 352 establishments; bricklaying, 478; building trades, 6,060; clothing, 1,728; cooperage, 484; food preparations, 1,419; furniture, 491; lumber, 395; metals and metallic goods, 1,595; mining, 2,060; stone, 468; tobacco, 2,959; transportation, 1,478. These represent 89·35 per cent of the whole number subjected to strikes. In lockouts, five trades bore 80 per cent of the whole burden, as follows: Boots and shoes, 155 establishments; building trades, 531; clothing, 773; metals and metallic goods, 76; and tobacco, 226; or a total of 1,761.

Besides completing the field work for this report and the compilation of the information, the bureau has carried on almost to completion the investigation begun last year concerning the moral, physical, and economical conditions of the workingwomen of great cities, and has continued its investigation into the cost of the distribution of great staple products. It has also undertaken, according to congressional instruction, the collection of statistics of marriage and divorce in the United States, a report of which may be submitted before the close of the present session of Congress.

Myopia.

A very sensible decree has just been issued by the Austrian minister of public instruction, forbidding the use of books printed with small type in public schools, as shortsightedness is so prevalent among school children in Austria. Scientific supervision might very properly be given to school books in this country, attention being especially directed to the size of the type, length of line, and spacing of letters and lines. In the works published by the Clarendon Press no fault can be found in these respects, and speaking generally the school books of this country are well printed. The chief fault in German books is their adherence to the very dazzling Old English shape of the letters, which certainly severely tries the eyes by necessitating very close attention, and the evil effects of this is aided by the paper being coarse and by the light supplied being usually insufficient.—*Lancet.*

THE total wheat crop of the world is about 2,000,000,000 bushels, and at least 1,500,000,000 bushels are consumed in the countries in which it is grown, leaving a balance of 500,000,000 to supply countries growing no wheat or growing less than they consume. Speculation deals only with this balance that goes into general trade, and the speculators of the world in a single year will sell or transfer in their peculiar way forty or fifty times 500,000,000 bushels of wheat. In New York a single day sometimes witnesses a sale or transfer of 30,000,000 bushels of wheat. The damage done by speculation consists in lowering the price of the whole amount of actual wheat by this enormous inflation of "paper wheat," not a bushel in a thousand of which is ever delivered.—*Milling World.*

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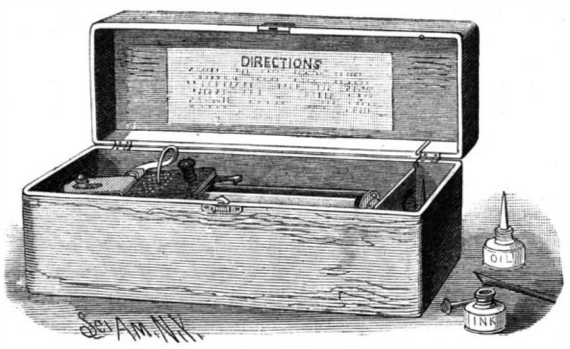
THE MORRIS TYPE WRITER.

We illustrate in this issue the Morris type writer. It is a machine designed to supply the want so much felt for a portable and low priced machine which in quality of work and rapidity of execution should yield to none of the higher priced and heavier ones. The machine was invented by Mr. Robert Morris, of Kansas.



MORRIS TYPE WRITER IN CASE.

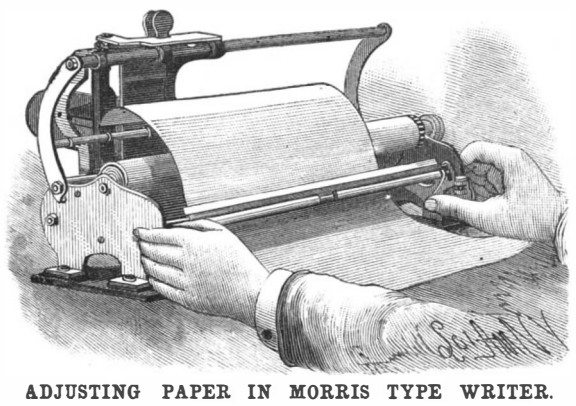
In 1885 he constructed or had constructed a number. These he sold, and although they were by no means the finished product we illustrate, yet so valuable were the features they embodied, that they worked successfully and to the satisfaction of their purchasers. In 1886 the inventor introduced them in the East, and after several hundred had been sold here, the manufacture was intrusted to the Hoggson & Pettis Manufacturing Company, of New Haven, Conn. The entire management was placed in the hands of this firm, and they at once set about improving the model, and by a process largely of simplification arrived at the present form.

The present model is in many respects an advance on the old one. As the machine from the first did good work, still better is to be looked for from the improved construction designed by the experienced firm who are its proprietors and who superintend its manufacture, on which a high grade of skilled machinists are employed.

The general features of the type writer are well brought out in the cuts. A swinging and reciprocating platen carriage carries the type, which are made of India rubber. When depressed sufficiently, one of the type is pressed against the paper which rests upon a roller. In order to guide the type to its place a guide pin is provided. This projects upward and enters a countersunk hole in the platen. There are as many of these holes as there are letters and characters. Each hole corresponds to a particular character, and the platen cannot be depressed without the pin entering the proper hole. The countersinking guides the pin, and the effect of the arrangement is that each letter can only be printed accurately in place and in alignment with the rest. In the view of the machine showing the platen turned back, the series of guiding holes can be seen to the right of the type.

Immediately above the type on the upper face of the platen the characters are engraved, and a finger points out the letter that will be printed on depressing the platen.

Underneath the type is an inking pad. At every depression of the platen the type are pressed upon this, so as to keep them charged with ink. Through the center of the pad an aperture is formed, large enough to permit one type to pass through, and through this the impression is given. The depression of the platen by a rack and pinion movement advances the type an exact distance for each impression.



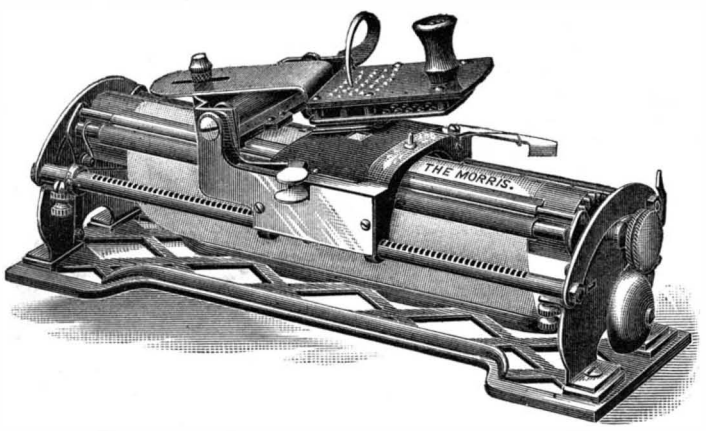
ADJUSTING PAPER IN MORRIS TYPE WRITER.

The operation from the illustration and description will be clear, and will be seen to be simple, rapid, and effectual. The operator holds the little knob with the fingers of the right hand. The platen is moved thereby until the proper letter comes under the indicator, when the platen is pressed downward. The guide pin enters the countersunk hole, the type descends exactly in its proper place, and the impression is made. At the same time the other type are brought in contact with the inking pad, so as to keep them in condition for printing. The platen after printing is pressed up to its original level by a spring. As it rises, the feed motion acts and the carriage advances one letter space. Between words or at the ends of paragraphs, different spacing can be produced by the operator. The thumb and finger pieces, seen projecting forward from the front of the carriage, are provided for executing these movements.

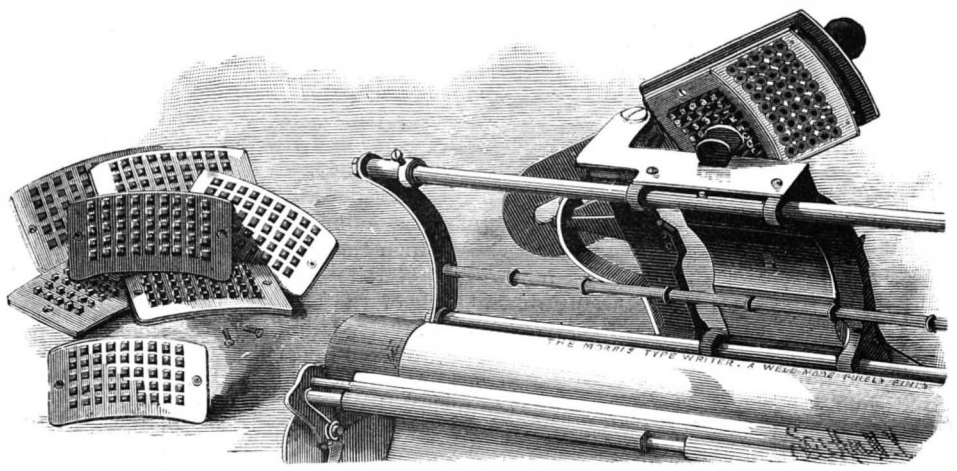
As the carriage bearing the platen approaches the end of its course, it rings an alarm bell to notify the operator. Forty-five characters, including the alphabet, numerals, punctuation, per cent, and dollar marks, are contained on each sheet of type. Different and interchangeable styles are provided for use on the same machine. The strength of the rubber backing is not, however, relied on to secure accurate placing of the type. Their faces project through holes in a metallic plate, so that they cannot move laterally. The type plate is always in full sight, never being covered by the operator's hand. Its area is so small that all the characters are kept easily within the limits of most distinct vision. The guide pin, after passing through the guide holes, strikes the upper plate of the platen carriage. This contact takes place every time a letter is printed, and insures a perfectly even pressure, so that all the characters are printed with equal distinctness. Every portion of the machine, except the type plate and rolls, is of metal, with interchangeable parts throughout. Its weight is four and a quarter pounds, and with its box and appurtenances, seven pounds.

It will be noticed that it is not a ribbon printing machine, but that it does its work by direct contact between paper and type. The feed of the paper is managed by the rotation of the bed roller, effected by the milled head on the right of the machine. A stop motion is provided to secure perfectly accurate feed.

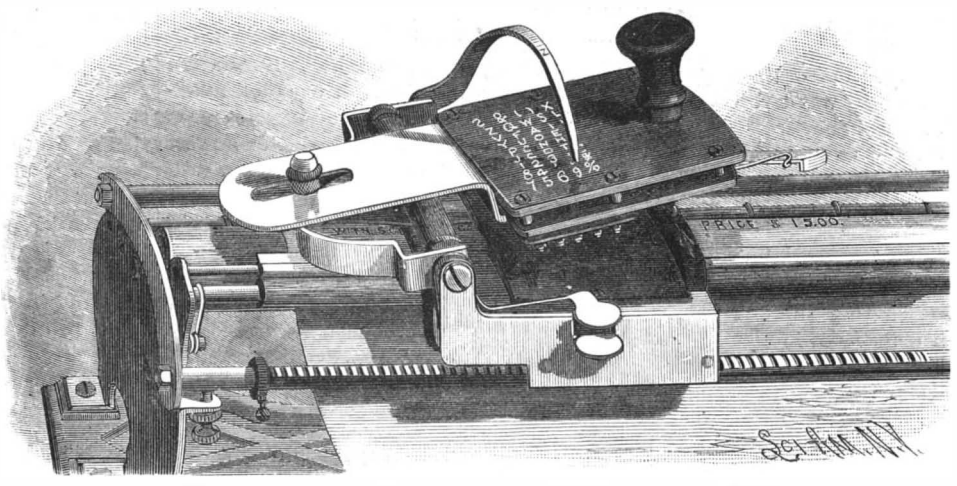
All inquiries concerning this machine may be addressed to the Hoggson & Pettis Manufacturing Company, New Haven, Conn.



THE MORRIS TYPE WRITER—GENERAL VIEW.



UNDER VIEW OF PLATEN AND SHEETS OF TYPE OF MORRIS TYPE WRITER.



PLATEN AND CHARACTER PLATE OF MORRIS TYPE WRITER.

THE MORRIS TYPE WRITER IN USE.

Four Things Worth Knowing.

Chas. Reiss gives in the *American Jeweller* the following useful receipts:

Immerse steel or iron in a solution of carbonate of potash for a few minutes, and they will not rust for years, not even when exposed to damp atmosphere.

To restore the luster of dead silver work, gilt clock cases, etc., dissolve one ounce of cyanide of potash in one quart of pure water, empty it into a bottle, and label it "poison." When to be used, place the article in an earthen vessel, cover it over with the solution, and in five minutes the lusterless appearance will be removed. Preserve the fluid for future use.

The following method for bluing small steel pieces evenly will prove satisfactory: You first blue the object without any special regard as to uniformity of color. Should it prove to be imperfect, take a piece of clean pith, or a piece of dead wood that will not crumble too easily, and whiten the surface with rouge without letting it be too dry. Pieces when thus prepared, if cleaned and blued with care, will assume a very uniform tint.

To prepare a beautiful gold beetle colored bronze, use the following method: Mix equal parts of chromate of potash and table salt. After the powder is finely mixed, let it pass through a sieve, then put this powder into a crucible and cover it with a layer of salt. Cover the crucible and allow the contents to boil half an hour. After cooling, wash out the contents carefully with water, and the mass on being rubbed will show a beautiful bronze.

Platinum can be made to adhere to gold by soldering, in the following manner: A small quantity of fine or eighteen carat gold should be sweated into the surface of the platinum at nearly a white heat, so that the gold shall soak into the face of the platinum. Ordinary solder will then adhere firmly to the face obtained in this manner. Hard solder acts by partially fusing and combining with the surfaces to be joined, and platinum alone will not fuse or combine with any solder at a temperature anything like the fusing point of ordinary gold solder.

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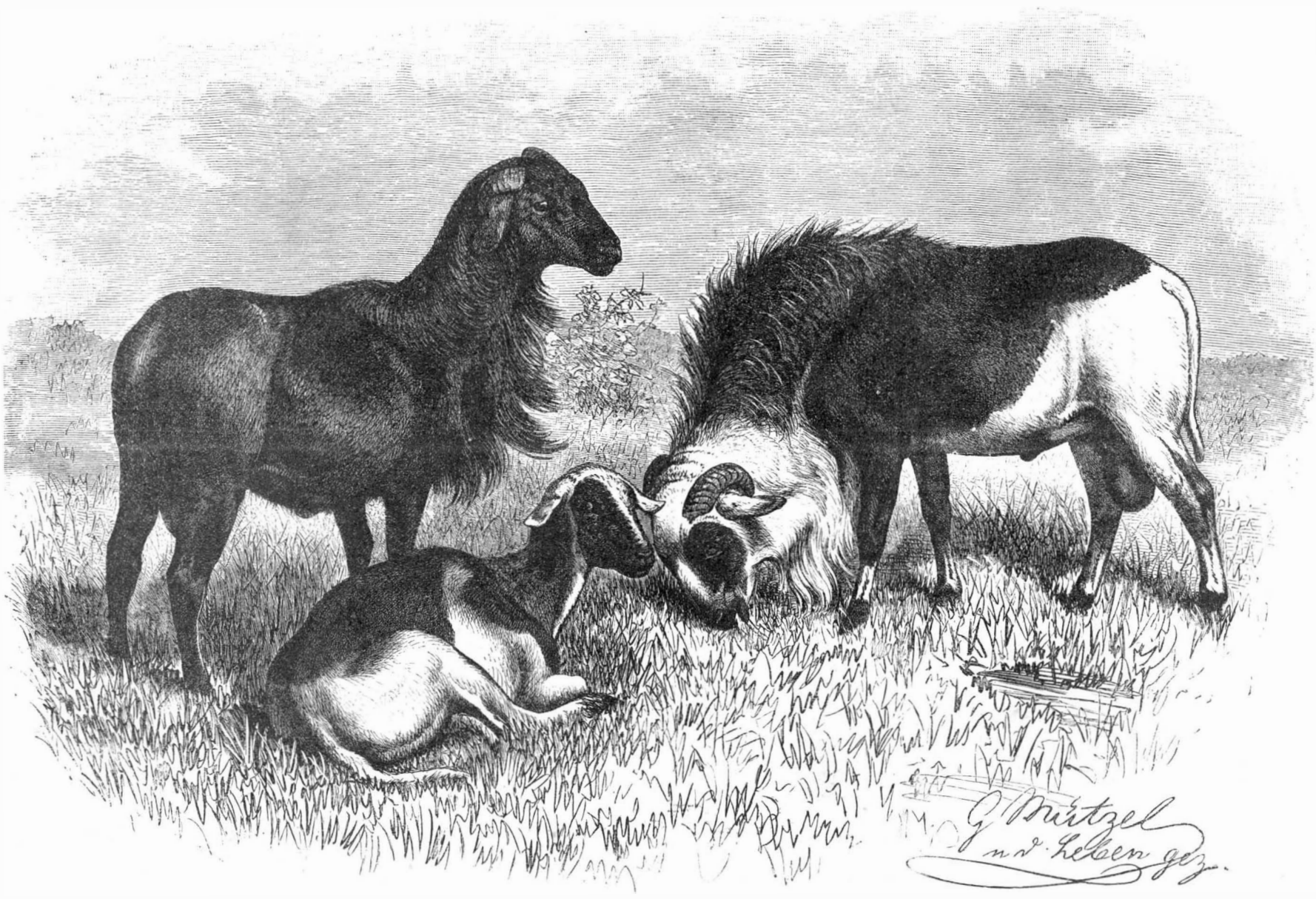
AFRICAN SHEEP IN THE BERLIN ZOOLOGICAL GARDENS.

Their essential characteristic is that they are not covered with wool like their European relatives, but have stiff, coarse hair. There is a diversity in their size and shape, which varies according to the food and climate of the different places in which they are raised.

Sometimes the profile of the forehead is straight, then again it is more or less curved. The ears vary in length and breadth, sometimes standing out and sometimes hanging down; while the body is more or less curved on the sides. The length and strength of the legs and tail are likewise varied, the latter sometimes showing a tendency toward clumsiness in size.

The color of these sheep is always black and white, the white forming the groundwork for the black, round spots, which are found upon the nose, the eyes, ears, and just above the hoofs.

The shape of the specimens here illustrated is rather small and graceful, the profile is straight, the finely shaped ears stand out horizontally from the head, the line of the back is even, and the tail is of medium length. The body is curved, the limbs are slender, very similar to those of a deer.



AFRICAN SHEEP IN THE BERLIN ZOOLOGICAL GARDENS.

The hair is short and even, except on the buck, and even then it grows long only on the under side of the neck. The large colored spots which are distributed about the body are essentially black and characteristic.

The Cameroon sheep are only useful as food, but they are considered of great importance among the black population, on account of their easy fattening qualities. —*Illustrirte Zeitung.*

Removing the Ring.

"Will you please saw this ring off my finger?"

It was an old woman who made this request of a Broadway jeweler, and as the worker in gold and silver took the wrinkled, though fat and shapely, hand in his it trembled violently, and a tear dropped upon the counter.

"Excuse me," continued the old lady, "but it is my wedding ring. I have never had it off since I was married—forty-five years ago. I have refrained from having it cut, hoping that my finger might get thinner and that I could take it off without breaking it."

"And what if I can remove it without cutting?" inquired the jeweler.

"But can you?" said she, looking up in a credulous way. "If you can, do it by all means."

Then the jeweler took the swollen finger and wound it round from the top downward in a length of flat rubber braid. The elastic cord exerted its force upon the tissues of the fingers gently and gradually until the flesh seemed to be pushed down almost to the bone. The old woman's hand was then held above her head for a brief interval. Then the bandage was quickly uncorded and rewound about the member. This was repeated three times, and finally it was found upon uncovering the finger that it was small enough to admit of the ring being removed with ease.

"I have never failed but once," said the jeweler, "and I have removed many rings from fingers even more swollen than yours. Do I charge for it? Oh, yes. I ask the same amount that I would get if the ring were left to be mended after being cut. One dollar. Thank you!" and as he turned to his bench and the old woman left the store, he added: "But after all, she might have done the same thing herself. It's not the work, however, I charge for. It's the 'know how.'"

Naval Engineers.

The Secretary of the Treasury has issued the following rules concerning the examination of applicants for the position of second assistant engineer in the United States revenue marine.

A candidate for an appointment as second assistant engineer must be not less than twenty-one nor more than thirty years of age; he must be of good moral character and correct habits; he must have worked not less than eighteen months in a machine shop and have had responsible charge of a steam engine, or else have served not less than that period in charge or assisting in the care and management of the machinery of a steam vessel in active service. Upon examination, he must be able to describe and sketch all the different parts of the marine steam engine and boilers, and explain their uses and mechanical operation, the manner of putting them in action, regulating their movements, and guarding against danger. He must write a fair, legible hand, be well acquainted with arithmetic, simple mensuration, English orthography and composition, also with rudimentary mechanics and its practical applications; he must possess some skill in the use of ordinary hand tools, and have a fair practical knowledge of the nature of heat and steam, of the general laws in relation to the expansion of steam, of the use of the indicator and interpretation of diagrams, of the chemistry of combustion and corrosion, of the composition of sea water and use of the salinometer, and of the usual calculations to determine loss by blowing, gain by heater, and water necessary for condensation.

No person otherwise qualified will be commissioned as an engineer before he has shown his ability to perform duty at sea in a satisfactory manner for a period of at least six months. This service may either antedate or be acquired subsequent to an examination.

No person will be originally appointed to a higher grade than second assistant engineer, nor until he shall have passed a physical and professional examination. The physical examination shall precede the professional, and if a candidate be rejected physically, he will not be examined further. All professional examinations will be competitive in character, and applicants who pass the minimum standard required in the several subjects will be placed upon the list of persons eligible for appointment, in the order of the excellence of their examinations, respectively. From this list appointments will be made in regular order, as vacancies may occur, until another examination.

No person will be designated for examination until he has filed in the department the necessary certificates showing his proper qualifications as to character, habits, and time or times of service, and the ability that has been displayed during such service.

Any person producing a false certificate of age, time of service, or character, or making a false statement to a board of examination, will be dropped immediately.

Any person who, subsequent to his examination, may become disqualified from moral considerations will not be appointed.

CRYSTALLIZED tin plate has a variegated primrose appearance, produced upon the surface by applying to it in a heated state some dilute nitro-muriatic acid for a few seconds, then washing it with water, drying, and coating it with lacquer. The figures are more or less diversified, according to the degree of heat and relative dilution of the acid. The *Iron and Steel Trade Journal* (London) tells its readers how this crystallization is produced. Place the tin plate, slightly heated, over a tub of water, and rub its surface with a sponge dipped in a liquid composed of four parts of aquafortis and two of distilled water, holding one part of common salt or sal ammoniac in solution. When the crystalline spangles seem to be thoroughly brought out, the plate must be immersed in water, washed either with a feather or a little cotton, taking care not to rub off the film of tin that forms the feathering, forthwith dried with a low heat, and coated with a lacquer varnish, otherwise it loses its luster in the air. If the whole surface is not plunged at once in cold water, but is partially cooled by sprinkling water on it, the crystallization will be finely variegated with large and small figures. Similar results will be obtained by blowing cold air through a pipe on the tinned surface, while it is just passing from the fused to the solid state.

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Tricks of Memory.

Memory, which differs so greatly among individual men, varies also in such marked degree in the same person at different times that we are all interested in the inquiry how far memory is a measure of mental strength. In childhood and boyhood we find memory occupying so high a position among mental qualities that the idea grows up with most of us that he who has the best memory has also most talent, if even a remarkable memory be not regarded as of itself proving absolute genius. At least this is so in most of our schools, where the boy who remembers his lessons best takes highest position, not he who best understands them.

I learned very early that memory and mental power, though they may be associated together, are yet very different things. I valued my memory, which had often stood me in good stead in examinations, the only tests with which boyhood is apt to be acquainted; but I valued more the power of understanding and enjoying the reasoning of dear old Euclid, the one geometrician with whom, in those days, English school lads could become acquainted. Soon after I had left school—and when I was a freshman at college—I made the acquaintance of a young man of about my own age who possessed a most marvelous memory, while he also showed most marvelous mental density. He had occasion to pass examinations in Euclid, and one would have said that he would have been singularly successful in these examinations, for though he had only read through our college Euclid once, he could recite or write out the whole of it. Or, if preferred, he could begin at any point where one might start him and reproduce any quantity *verbatim et literatim—atque punctuatim*, so far as that was concerned. But not only was he utterly unable to understand a word of it all—he had not even brains enough to keep his real ignorance of Euclid to himself. He was always forgetting the good old rule *ne quid nimis;* and as he did not know where to stop in his marvelous recitations, the examiners naturally came to the conclusion, perfectly justified by the facts, that though he knew his Euclid by heart, he knew nothing about geometry. His knowledge was akin to that of one who should repeat by rote a number of Greek or Hebrew words, the meaning of which was unknown to him; or like that of a tutor I once had, who, when hearing me deal with a problem in Euclid, would send me back to relearn my lesson if I called a triangle A C B instead of A B C, as the book showed it.

We need not then either despair of our mental powers when we hear of marvelous feats of memory, or think that our minds are failing because with advancing years our memory may occasionally play us false. Memory, as Dr. Diordat, of Montpelier, long since pointed out, and as hundreds of facts show, is rather the offspring of the vital force than of the intellectual principle; and it is not surprising if in old age, when the vital force diminishes, memory should sometimes fail, even while the intellectual power preserves its full integrity. As for marvelous feats of memory, though they certainly indicate possibilities of future developments which would greatly increase man's grasp over mental problems, they need no more discourage those who feel incapable of any achievements in this line than the mental powers of Blind Tom should cause those who see his performances to despair because they can never hope to do the like.

The examples themselves which most strikingly display the capacity of special brains for remembering words and syllables show also how little this capacity has to do with intellectual power—some of them indeed seem almost to suggest that a very keen memory may be a mark of disease. That excessive keenness of memory may result from a diseased cerebral action is indeed certain; but, fortunately, we are not obliged to regard this fact as giving any unpleasant significance to exceptionally good powers of remembrance. If foolish or even idiotic persons, or persons in the delirium of fever, have manifested remarkable memories, men like Macaulay, Prescott, Euler, and others have had marvelous memories without being feeble-minded and without the aid of disease.

Pepys tells us of an Indian who could repeat a long passage in Greek or Hebrew after it had been recited to him only once, though he was ignorant of either language. This man would doubtless have been able to repeat (so far as his vocal organs would permit him to imitate the sounds) the song of a nightingale or a lark, through all its ever-varying passages, during ten or twenty minutes, and with as much understanding of its significance as of the meaning of the Greek and Latin words he recited so glibly. We certainly need not envy that particular "poor Indian" his "untutored mind," though as certainly the power he possessed would be of immense value to a philosopher.

If any one is disposed to believe that perhaps, after all, that Indian may have been a man of powerful understanding, a case of even more wonderful recollection of mere sounds will at least dispose of the idea that the man's peculiarly retentive memory proved mental power. Coleridge relates in his "Literaria Biographia" that in a Roman Catholic town in Germany a young woman who could neither read nor write was seized with a fever, during which, according to the priests, she was possessed by a polyglot devil. For she talked Latin, Greek, and Hebrew, besides uttering sounds which, though not understood by her hearers, had doubtless meaning, but belonged to languages unknown to them. "Whole sheets of her ravings were written out," says Coleridge, "and were found to consist of sentences intelligible in themselves, but having slight connection with each other." It appeared rather inconsistent with the theory of demoniac possession that some of these sentences were biblical; but as it is proverbial that the devil can quote Scripture for his purpose, this evidence might not have availed to save the girl from such rough treatment for her "possession" as would probably have served very ill for her fever. Fortunately, a physician who, being skeptically inclined, was disposed to question the theory of a polyglot spirit, "determined to trace back the girl's history. After much trouble, he discovered that, at the age of nine, she had been charitably taken by an old Protestant pastor, a great Hebrew scholar, in whose house she lived till his death. On further inquiry it appeared to be the old man's custom for years to walk up and down a passage of his house into which the kitchen opened, and to read to himself in a loud voice out of his books. The books were ransacked, and among them were found several of the Greek and Latin fathers, together with a collection of rabbinical writings. In these works so many of the passages taken down at the young woman's bedside were identified that there could be no reasonable doubt as to their source."

If the girl had remembered these passages in a normal way, and had merely uttered them during her sickness, the story would have been remarkable enough, since she was altogether uneducated. But, as a matter of fact, she remembered none of them in health, either before or after her sickness. It was doubtless the activity of the circulation during the access of fever which brought out, as it were, the impressions of sounds really recorded in the brain, but so lightly that except during such situation she remained unconscious even of their existence.

A case cited by Dr. Abercrombie confirms the suggestive theory that the stimulus which fever gives to the circulation (sign of disease though it is) may bring dormant mental impressions into temporary activity. A boy at the age of four had undergone the operation of the trepan, being at the time in a stupor from a severe fracture of the skull. After his recovery he retained no recollection either of the accident or of the operation. But at the age of fifteen, during an attack of fever, he gave his mother an account of the operation, describing the persons who were present, and even remembering details of their dress and other minute particulars.

Even an accident may stimulate the memory in such sort as to recall long-forgotten neutral impressions, and so to convey that the mind is regularly retentive. Dr. Abercrombie relates a case of this kind which suggests many perplexing problems in regard to memory. A man who had been completely stunned by a blow on the head remained still partially out of his mind when he had recovered from the first effects of the blow. In his unconscious state he spoke a language which nobody in the London Hospital, to which he had been removed, could understand, but which was presently found to be Welsh. It was subsequently discovered that, though Welsh by birth, he had been thirty years away from Wales when the accident occurred, and had quite forgotten his native tongue. On his restoration to full consciousness he lost his Welsh again completely, but recovered his English.

The effects of an accident in destroying temporarily—or, so far as it appears, wholly—all neutral impressions received within certain intervals, are sometimes curious enough. Thus Dr. Carpenter mentions the case of a friend of his—a clergyman—who was pitched out of a phaeton, and received a severe concussion of the brain. On recovering he found that he had forgotten all that had happened, not only when the accident actually took place, but during some previous time. The last thing he remembered was that he had met an acquaintance on the road, just about two miles from the accident.

An access of fever may produce, as we have seen, a local disturbance of brain functions. It is further worthy of notice also that the recollection a man has of events preceding intoxication is apt to be similarly limited in a definite but not readily explicable manner.

I remember a Cambridge man who, though not given to drinking, and now "a sober man among his sons," was more than once overtaken by liquor during the time when he had yet to learn his brain's exceptionally limited power of resisting the action of intoxicants. This man would not only be unable to recall what had happened during the time when he was intoxicated, but a number of preceding events which had taken place while he was still perfectly sober. His friends would tell him of things which had happened a full hour before he was "overtaken" (as the quaint expression has it), which had altogether passed from his remembrance. He used to say that his recollection was clear up to a certain point, beyond which everything seemed "veiled."

But it was clearly shown by an experiment which he arranged for his own satisfaction—being one of the inquisitive sort—that the veiling was, as it were, extended backward from the time of actual intoxication, for whereas his forgetfulness extended over the whole interval from the first glass of wine (which he always remembered drinking) to the sixth or seventh, at which intoxication began, he could remember with accustomary readiness all that happened at a sitting where he had drunk four or five glasses of the same wine. Of course he had to trust to his friends to note for him at what stage intoxication began. In fact, until he had learned this from others he could know little about it, because of the peculiar veiling of past events which took place after he had passed that stage. But his friends not being of the sort who rejoice to see a man under the influence of liquor, he had confidence in them; and besides, he could prove so much as this for himself, that whereas he could never remember more than the first glass if he drank too much, he could drink four or five glasses safely, remembering all that happened. What he could not learn for himself was, how many more glasses he could take without intoxication. At last he could only obtain this knowledge in such sort that he was conscious of it while intoxicated; for his friends found that after the sixth or seventh glass, which produced intoxication, he could always remember every detail of what had happened during previous accessions of the temporary insanity we call drunkenness.

The way in which this man's mind came out from the "veiling" was as strange and as suggestive as the way in which it was thrown under that veiling. I remember being present at the moment when consciousness or sanity (whichever we choose to call it) came back to him. He was a mathematician, and a man had put in his hand to test his condition a mathematical treatise on mechanics, over which my friend had maundered, as drunken men will. Suddenly his mind seemed to straighten up, and, in response to a remark that he was "screwed," he turned to the pages in the book dealing with the screw, and said quaintly, "See here, A. You're a classical man, and know nothing about mathematics; but these angles, alpha and beta" (showing a diagram) "represent the pitch of these screws. Now you needn't pitch into me about being screwed, for if I'm screwed at an angle alpha, you're screwed at an angle beta." (A. really was at the time the worse for liquor, but the other, who had been so a moment before, was, from the moment he had opened the book, perfectly clear-minded, and a few minutes later was at his mathematical studies.)—*Knowledge.*

The Parkes Smelting Process.

A method of treating the concentrated pyritic products obtained in the working of gold and silver bearing quartz has lately been perfected by Mr. Alexander Parkes, the well known inventor of the process of desilvering lead by means of zinc, which has now almost entirely replaced the Pattinson process both in Europe and America. These concentrates, which even in their most enriched forms are very siliceous, contain iron pyrites and other sulphides and arsenides so intimately associated with the gold and silver that they can as a rule only be very imperfectly reduced by amalgamation, even after undergoing a preliminary calcination. Mr. Parkes proposes to treat them by a concentrating fusion resembling the Swansea coarse metal process, for which purpose they are fluxed in a reverberatory furnace, without previous calcination, with a mixture of ferric oxide, lime, sulphate of soda, fluor spar, and carbon, the ore and fluxes being finely reduced and intimately mixed. The charge is completely melted in about three hours and a half, giving as products slag and regulus. The latter, which is exceedingly fluid, is essentially ferrous sulphide, and contains practically the whole of the valuable contents of the ore, while the slag, from the diversity of the fluxes employed, being comparatively low density, and fusing easily, is sufficiently free from interspersed regulus to be regarded as clean, and may be thrown away. The regulus contains a small quantity of sulphide of sodium, and falls to powder when damped with water, in which state it is subjected to a partial calcination until about half the sulphur is expelled, when it is run down with lead in order to collect the gold and silver for cupellation. The latter stages of the process may, however, be varied according to circumstances; the essence of the method being the retention of the whole of the original sulphur in the material, and utilizing it as a vehicle for the collection of the metallic contents, instead of getting rid of it by a preliminary calcination. The London *Engineer* says: The process has been carried on experimentally for some time at East Greenwich, where a large number of samples of refractory concentrates from many of the principal gold and silver producing localities in America and Australia have been treated with considerable success, the assays of the slags made by Messrs. Johnson, Matthey & Co. showing that very complete separation has been effected in most cases. The first practical trials of the method are to be made in New Zealand under the personal supervision of the veteran inventor, now in his 74th year, who sails for that colony in February next.

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Stolen Secrets.

One hundred years ago, before the day of protection by patents, what a man discovered in the arts and mechanics he concealed. Workmen were put on oath never to reveal the process used by their employers. Doors were kept closed, artisans going out were searched, visitors were rigorously excluded from admission, and false operations blinded the workmen themselves. The mysteries of every craft were hedged in by quickset fences of empirical pretension and judicial affirmation.

The *English Mechanic* relates the following: There used to be, close by Temple Bar, in London, an old chemist's shop. The proprietor of it, in days gone by, enjoyed the monopoly of making citric acid. More favorably circumstanced than other secret manufactures, his was a process that required no assistance. He employed no workmen. Experts came to sample, and assort, and bottle his products. They never entered the laboratory. The mystic operations by which he grew rich were confined to himself. One day, having locked the doors and blinded the windows, sure, as usual, of the safety of his secret, our chemist went home to his dinner. A chimney sweep, or a boy disguised as such, wide awake in chemistry, was on the watch. Following the secret-keeper so far on his way to Charing Cross as to be sure he would not return that day, the sooty philosopher hied rapidly back to Temple Bar, ascended the low building, dropped down the flue, saw all he wanted and returned, carrying with him the mystery of making citric acid. The monopoly of the inventor was gone. A few months after, and the price was reduced by four-fifths. The poor man was heartbroken, and died shortly afterward, ignorant of the trick by which he had been victimized.

The Secretion of Pure Aqueous Formic Acid by Lepidopterous Larvæ for the Purposes of Defense.*

BY E. B. POULTON.

It has long been known, that the larvæ of the genus Cerura (Dicranura) have the power of ejecting a colorless fluid from the mouth of a gland which opens on the prothoracic segment. The latter segment is dilated when the larva is irritated, so that the fluid is thrown in a forward direction, and for a distance of several inches. When the larva is touched, the head and anterior part are immediately turned toward the source of irritation, and the fluid is thrown in this direction.

In 1885 I found that the secretion was strongly acid to test paper, and that it caused very strong effervescence when placed upon sodium bicarbonate; while a little later I showed the fluid to Prof. Wyndham Dunstan, who told me that the characteristic smell of formic acid could be plainly detected. This opinion was further confirmed when it was found that silver nitrate was readily reduced by the secretion (Trans. Ent. Soc. Lond., 1886, part ii., June, pp. 156–57).

In 1886 I obtained a larger number of larvæ, and with the kind help of Mr. J. P. Laws I was enabled to show that the secretion contains about 33 per cent of anhydrous acid. All the well known qualitative tests were applied to the secretion and to the alkaline salts obtained by neutralizing with standard alkali. Among other tests, the secretion was found to dissolve the oxide of lead, a white crystalline salt being deposited.

Although only a very minute weight of this was obtained, Prof. Meldola kindly offered to estimate the amount of lead present in the salt. The weight was found to correspond to one of the basic formates of this metal formed by the action of the normal formate upon the excess of oxide. During the past summer I have had a very large number of these larvæ, and the investigation has been continued with larger amounts of secretion. The pipette has been applied for the removal of secretion between 500 and 600 times, and between twenty and thirty volumetric determinations have been made.

A mature larva which has not been previously irritated will eject 0·050 gramme of secretion, containing about 40 per cent of anhydrous acid. Half-grown larvæ eject nearly as much, but the fluid is weaker, containing about 33–35 per cent of acid. The rate of secretion is comparatively slow—*e. g.*, two days and a half after ejection, two large larvæ only yielded together 0·025 gramme of secretion. Two captured larvæ, to which the eggs of parasitic Ichneumonidæ had been affixed, only ejected 0·035 and 0·045 gramme of secretion, having incompletely made up the amount lost during the attack of the Hymenopterous insect.

Starvation lessens the amount of secretion, and also decreases the proportion of acid, but probably both these effects are due to general health, and do not imply the direct formation of the acid from the food. The different food plants—poplar and willow—do not make any difference in the amount or strength of the secretion. About half the total quantity of secretion obtained was made use of in preparing a relatively large amount of the normal formate, which is now in Prof. Meldola's possession. The weights of the constituent elements will be determined by combustion. The rest of the secretion has been used for other exact methods of estimation and analysis under the kind direction of Mr. A. G. Vernon Harcourt, the work having been conducted in his laboratory at Christ Church.

Mr. Harcourt suggested that it was most important to prove that the amount of acid shown to be present by volumetric analysis is formic acid, and nothing else. This proof was obtained in two ways: (1) A certain weight of the secretion was divided into two parts; the amount of acid in one of these was determined by the volumetric method, while the other was decomposed by strong sulphuric acid, and the carbon monoxide which was evolved was exactly measured in the apparatus for gas analysis, and the amount of formic acid present was calculated from the data thus obtained. The two percentages nearly corresponded, and, as the latter was the higher, it was obvious that no other acid could be present. (2) A certain weight (0·186 gramme) of secretion was heated in a tube over a water bath, and, after drying at 100° C., only 0·0004 gramme of solid residue remained, and this was probably accidental. The rest of the fluid was distilled into a tube containing carbonate of lead, and this was afterward heated to 100° C., and the water collected in drying tubes.

As a result, the increase in weight of the latter, and the tube containing lead carbonate, the weight of formate of lead obtained from the latter, and of sulphate of lead obtained from the formate, all corresponded almost exactly to the weights which would have been given by pure aqueous formic acid having this composition: water, 62·5 per cent; formic acid, 37·5 per cent.

Since writing the above I have received the results of Prof. Meldola's analysis, from which he concludes that the secretion consists of aqueous formic acid almost in a state of purity.

* Read before the British Association.

The Typhoid Poison.

Dr. Victor C. Vaughan, Professor of Physiological and Pathological Chemistry in the University of Michigan, has announced to the State Board of Health the result of a series of experiments, which have ended, he claims, in the confirmation of the germ theory in cases of typhoid fever. The fever was produced in a cat, with more completeness and success than has ever before attended such endeavors; and those of Dr. Vaughan's friends who have witnessed the experiments and their results declare that the germ theory in typhoid fever is now a settled fact. The cat inoculated showed all the symptoms of the disease, especially that of a greatly heightened temperature, a symptom heretofore lacking in all other cases of inoculation. Dr. Vaughan, in reference to his discovery, said:

"Last August there was an epidemic of typhoid fever in the village of Iron Mountain, a place in northern Michigan of about 4,000 inhabitants. Part of the town was supplied with water from a mountain spring and part from private wells from six to twenty feet deep. It was noticed that all those who used the spring water escaped the disease, while those who depended upon the shallow wells were generally stricken down. In all, there were many hundred cases and about forty deaths. I secured some of the water from these shallow wells, and with it experimented upon a number of cats, finally obtaining, after labors protracted over a period of six months, the result which I announce to the State Board of Health."

Pure Air Indicator.

It is estimated that the air in a room becomes distinctly bad for health when its carbonic acid exceeds one part in 1,000. An apparatus has been recently patented by Prof. Wolpert, of Nurnberg, which affords a measure of the carbonic acid present. From a vessel containing a red liquid (soda solution with phenolphthalein) there comes every 100 seconds, through a siphon arrangement, a red drop on a prepared white thread about a foot and a half long, and trickles down this. Behind the thread is a scale beginning with "pure air" (up to 0·7 per 1,000) at the bottom, and ending above with "extremely bad" (4 to 7 per 1,000 and more). In pure air the drop continues red down to the bottom, but it loses its color by the action of carbonic acid, and the sooner the more there is of that gas present.

AN example of deterioration in values is shown in the sale of the Great Eastern for less than $100,000. The original cost of the vessel was three and a half million dollars, but she was a gigantic failure from the start. The building of this ship, however, was of value in demonstrating that there was a limit in steamships in the direction of size. She has been of use also in the laying of the Atlantic cables. While those who invested their money in building this ship lost heavily in the venture, they can console themselves with the fact that their loss was not altogether in vain. The last report is that Barnum is trying to negotiate for its purchase, with a view of converting it into a mammoth floating show.

Drawing on Glass.

To write or draw on glass, it is necessary to impart to the surface a certain degree of roughness. This may be done by grinding or etching, but much more easily by applying some appropriate varnish. A good matt varnish is made by dissolving in two ounces of ether 90 grms. of sandarac and 20 grms. mastic, and adding benzol, ½ oz. to 1½ oz., according to the fineness of the matt required. The varnish is applied to the cold plate after it has set. The glass may be heated to insure a firm and even grain. To render the glass again transparent, after writing upon it, apply with a brush a solution of sugar or gum acacia.

Still better as a surface for writing or drawing is a varnish of sugar. Dissolve equal parts of white and brown sugar in water to a thin sirup, add alcohol, and apply to hot glass plates. The film dries very rapidly, and furnishes a surface on which it is perfectly easy to write with pen or pencil. The best ink to use is India ink, with sugar added. The drawing can be made permanent by varnishing with a lac or mastic varnish.

Greenish-Brown Patina for Brass and Bronze.

The bronze industry has long been devoting itself to the improving of the various processes by means of which art bronzes are given that "patina" so much admired by connoisseurs. In Germany much admiration is expressed for the rich tints that bronzes of Parisian make exhibit, and that usually vary from light yellow-brown to dark red-brown, frequently touched up with gold. Among these patinas, the one called in commerce Barbedienne bronze is among the most esteemed.

The "Portefeuille Economique des Machines" copies from a German journal a process devised by Mr. R. Hampschulte for obtaining a very beautiful and durable patina of a brown color, with greenish reflections, which may be applied without any expense, so to speak, other than that of manual labor, to all objects of bronze or brass.

Before all else, the surfaces to be treated must be perfectly cleaned and polished. Then the objects are immersed in a bath composed of 60 grains of sulphide of potassium to 5 quarts of water, to which dissolved potassa has been gradually added until the liquid is slightly mucilaginous to the touch.

After remaining in this bath for a few seconds, the objects are taken out and immediately put into another bath, very slightly, acidulated with sulphuric acid. The proportion of the acid is not given by the author, who confines himself to the statement that the water should have a slight acid taste.

As soon as the surface begins to verge on brown, it is rubbed with a metallic brush, under the action of which the patina reveals itself. If it be desired to deepen the tint, the object is passed through the two baths in succession again, and afterward vigorously brushed. This process is applicable to small objects chiefly.—*Revue Industrielle.*

A Practical Man's Experience with Steel.

Twelve or fifteen years ago, writes G. W. Tinsley, to the SCIENTIFIC AMERICAN, when I wanted cast steel for any purpose, I went to the hardware merchant and purchased a piece that would serve my purpose best, with the very least forging, that is, I got the nearest size to the one I wanted, which I could find. If too small, I could "stove" it a little; if too large, it was drawn. But after a while I found that some steel would make springs for gun locks, knife blades, surgical instruments, etc., with but a few failures, probably one in one hundred; while with other pieces I could not make one spring in a dozen stand. The first fact I was able to discover was that every piece of steel that gave me trouble was clean and new.

For a year or two after, I avoided this clean pigeon blue colored article; and I bought anything that was rusty, regardless of size. This naturally led me to suppose that my trouble was all located in an article lately put upon the market. But as time corrodes all things, all the pieces of steel kept by the dealers became more or less rusty, and I was no longer able to pick out the rusty steel that used to be good, or discard the clean and bright blue as bad; and so my rule that had served me well died a natural death. At last it occurred to me to examine the qualities of steel under a glass. This I did, and found the one that gave me trouble was coarse in grain, showing large crystals, with spaces between (like those in burnt steel); while that which gave no trouble was fine in grain and seemingly perfectly homogeneous throughout.

When I go to buy steel now, I carry my little glass in my vest pocket. I don't know the power of it, but I do know that it saves me a power of work and vexation.

Firemen Clothed in Asbestos.

The London firemen are about to be uniformed for duty in asbestos cloth, a material which has already been adopted by the Paris fire brigade with satisfactory results. Equipped in this incombustible apparel, the fireman is practically master of the flames.

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ENGINEERING INVENTIONS.

A rail joint has been patented by Mr. George H. Williams, of Nashville, Tenn. This invention covers a novel construction and combination of parts to secure a perfectly rigid joint, as solid as the rail itself, in which the jarring and jolting of cars passing over the joint is prevented and the wear of the meeting points reduced to a minimum.

A railway tie has been patented by Mr. Joseph W. Smith, of Mount Carmel, Penn. The invention covers a novel construction and combination of parts to provide a secure fastening for the rails, and which, while holding the rails securely in position, will be sufficiently elastic to admit of rapid traveling without injury to the rolling stock or discomfort to passengers.

A car coupling has been patented by Mr. Charles G. Crosse, of Sun Prairie, Wis. The coupling hook is automatically thrown into engagement with a link or bar brought to bear against it, and is uncoupled therefrom by means of a mechanism connected to the hook and extending to the car, the device being also applicable for coupling a pole or shafts to a carriage.

A car coupling has been patented by Mr. Jonathan Hendershot, of Evelyn, West Va. By this invention the drawhead of the car is provided with a vertically swinging member, having at its free end a downwardly projecting coupling lug, which, after the entrance of the coupling link, may be locked against upward movement by a block sliding in the top of the drawhead.

A mechanical movement has been patented by Mr. James F. Hanley, of Charleston, S. C. A double crank shaft is combined with a vibratory lever pivoted coincidently with the centered axis of the shaft, the lever being connected upon opposite sides of the shaft by links and rocking arms, and also connected with a rotary shaft, making a compact, evenly balanced arrangement of parts to facilitate running at high speed, and apply power in both directions.

AGRICULTURAL INVENTIONS.

A cotton chopper has been patented by Mr. William P. Clark, of Elberton, Ga. This invention covers a novel construction and arrangement of parts whereby, as the main wheel revolves while the machine is being drawn forward, a gear is operated to work a chopper with revolving knives, but such gear may be thrown out without stopping the machine, which is simply and strongly built.

A compensating clutch for corn planters has been patented by Mr. John S. Johnson, of Waukon, Iowa. It is an improved gear for connecting the wheels and axles with the seed-dropping device, by which the latter will be governed by the wheel having the slowest movement, and disconnected from the fast moving wheels, thus removing irregularities by slipping in moving over obstructions on the surface of the ground.

MISCELLANEOUS INVENTIONS.

A drawbridge has been patented by Mr. Oscar F. Balston, of Brooklyn, N. Y. It has tubes supported upon the masonry, in combination with a bridge having trucks, making a longitudinally moving drawbridge, in which no central pier will be required, and so that vessels can lie close to the bridge.

A bolt has been patented by Mr. Jonas Potter, of Morrellville, Pa. It has a spring yoke connection, with means for detaching the bolt from its connection, and is designed to dispense with the use of cotter pins or nuts in retaining the bolt in a given position, while the bolt may be quickly and easily detached, even though badly rusted.

A box for the sale of goods has been patented by Mr. Charles T. Rosenthal, of Batesville, Ark. It is made up of and fitted with a series of partitioned receptacles or compartments, arranged in rows, one in front of the other, and designed to be placed in glass-covered show cases, to conveniently hold and display goods.

A feed for stone saws has been patented by Mr. Neil McIntyre, of Brooklyn, N. Y. It is for saws armed with diamonds or other hard stones used as cutting tools, and the invention provides a novel arrangement of continuous feed, whereby the saw is designed to cut equally well upon the forward and back stroke.

A press has been patented by Mr. Lorenzo D. Gordon, of Tenaha, Texas. This invention covers an improvement in lever powers applicable especially for presses for baling cotton, hay, etc., or for expressing cotton seed, castor bean, and lard oil, the contrivance being one which can be worked or applied either horizontally or vertically.

A check hook has been patented by Mr. William R. Moore, of Unionville, Pa. It consists of a peculiarly shaped spring, formed of a single piece of spring wire, applied to the hook by means of the same bolt that secures the hook to the saddle, making a check hook from which the check rein cannot be accidentally disconnected.

A chicken coop has been patented by Mr. George W. Brown, of McNairy, Tenn. The invention covers a novel construction of coops especially adapted for the transportation of fowls, etc., making a light, inexpensive, and strong structure, in which the stock will have plenty of air and can be conveniently inspected.

A punch has been patented by Mr Albert Burrowes, of Toronto, Ontario, Canada. It is for punching oblong apertures in belts to facilitate lacing their ends together, and has a straight shank with a semicircle at one end, which semicircle continues into parallel sides, forming a U-shaped cutting edge at the lower end of the shank.

A water cock has been patented by Mr. Henry D. Medrick, of Port Jervis, N. Y. It is especially adapted for the water supply pipe of a locomotive, and is designed to filter the water before it passes to the injector, and also to provide means for preventing the cock from freezing up in cold weather, and for quickly and conveniently cleaning it.

A washing machine has been patented by Mr. George F. Dunning, of Deep Water, Mo. It is designed to afford a simple and effective machine, to be operated with economy of time and labor, and is arranged to give easy access to all its parts for handling the clothes or washing fluid, and for cleaning the machine when the work is finished.

A liquid measuring faucet has been patented by Mr. Herman M. Nye, of Corydon, Ind. It is a combined supply and discharge faucet, in connection with an intervening reservoir, on which is marked a measuring scale, with various novel details, making a faucet whereby liquids may be measured as drawn from a cask or receptacle.

A combination tool has been patented by Mr. James Angus, of St. Catharines, Ontario, Canada. The body of the tool is of malleable iron or steel, and it is made of few and simple parts, to be used as a saw set, stove cover lifter, pot hook, can perforator and can opener, screw driver, corkscrew, tack puller, wrench, and a sad iron holder or plate stand.

A method of and apparatus for producing animated pictures of natural scenery and life has been patented by Mr. Augustin Le Prince, of New York City. It consists of a photo-camera and stereopticon adapted to show pictures in the order and time in which they were taken, in quick succession, on a finely ground plate glass, to produce the effect of the objects themselves in motion.

A carburetor has been patented by Mr. François J. Lothammer, of Paris, France. Combined with a compressed air reservoir and its supply pipe is a carbureting chamber within the reservoir, a valved pipe leading from the reservoir into the chamber near its bottom, a hydrocarbon receptacle surrounding the chamber, a heating chamber, and various other novel features.

An automatic device for shutting water cocks, etc., has been patented by Mr. James W. Brook, of Lynchburg, Va. This invention covers a novel combination and arrangement of parts whereby dripping water, as it freezes in cold weather, will operate a balanced mechanism to close a valve in the service pipe, or the device may be used to open or close a window and regulate ventilation.

A folding fire escape has been patented by Mr. Ira B. Stillman, of Wellsville, N. Y. It is a sectional folding ladder, the side lengths made of short lengths of wire cord connected by rivets, the rivets constituting the rounds of the ladder, the upper sections of the ladder having means for connection with the building, while the lower round is preferably formed from a bolt, the whole being adapted to pack in a very small space.

An automatic cut-off for water tanks has been patented by Mr. James Pocknell, of Jersey City, N. J. It consists of a bucket on one end of a bell crank lever, in which discharges the overflow pipe of the tank, another weighted bell crank lever being connected therewith, the weight adapted to actuate a lever connected with the valve of the steam supply for the pump, or with a shifting lever connected with the driving belt of the pump.

A safety inkstand has been patented by Mr. Louis B. Prahar, of Brooklyn, N. Y. This invention relates to inkstands wherein the bottle is inclosed by an inner and outer case, each having a cover, and provides for forming the springs and strips carrying the hinges as part of a metal frame shaped to embrace the inner casing, to act on its opposite sides, whereby the inkstand can be made almost entirely by machinery, and will be practical, durable, and comparatively cheap.

An envelope for newspapers, etc., has been patented by Mr. Robert W Macgowan, of New York City. The invention consists in making two rows of perforations in the wrappers for articles put up in roll form, as newspapers, engravings, etc., the rows of perforations converging to make a central tapering strip which is readily torn out when started at one edge, thus easily loosening the wrapper without risk of the paper or article contained being torn or injured in removing the envelope or wrapper.

NEW BOOKS AND PUBLICATIONS.

HOME EXPERIMENTS IN SCIENCE FOR OLD AND YOUNG. By T. O'Conor Sloane, A.M., E.M., Ph.D. Illustrated by 97 engravings. Philadelphia: H. Carey Baird & Co. 1888. Pp. 261. Price, $1.50.

Those of our readers who have followed the series of articles published in our columns during the last year, by the author of the above work, will doubtless be glad to find them arranged in book form. But while the papers in question form the basis of the work, they are very far from constituting the whole. Much new matter is added, the experiments are placed in systematic order, and the work is brought into such shape that it is really to some extent a manual of physics. In the opening portion the manufacture of apparatus is spoken of. The subjects of wood, metal, and glass working are treated, with the limitation of processes to what the unskilled worker can do, as one great object of the book is to bring experiments within the reach of the teacher, amateur, and youth. The subject of experimental science in general, its place and its importance, is also treated of. Then the main portion of the book begins with a chapter on mechanics. This is replete with experiments and examples of the laws of force, impact, centrifugal force, elasticity, momentum, etc. The principal laws of mechanics being disposed of, the divisions of physics are attacked. Gravitation, hydraulics, and pneumatics comprise the next series of experiments, with many instances of the application of laws, and practical remarks. Atoms and molecules are treated by themselves, and introduce the subject of molecular physics. Here Professor Osborne Reynolds' new and celebrated experiments in dilatancy are described *in extenso*, so that any child of intelligence can perform them sucessfully. Capillarity is fully treated, some entirely new examples and experiments being presented. The illustration of the constitution of a water drop, and the formation of bubbles of metallic mercury, are two specially interesting experiments. Soap bubbles come next, and an exhaustive series of illustrations of the phenomena of films, all performed with almost no apparatus, except a few pieces of wire, affords probably the fullest treatment of the subject accessible. Formulæ for various soap bubble solutions are collected and given here. Heat, sound, and light follow, with a quantity of experiments, and a chapter on scientific lecturing closes the work. In this last portion the suggestion is made that science lectures should be made a feature of home amusement, so as to take the place of charades and dramatic performances. This certainly opens up a new field for the energies of the young lover of science. The work is beautifully bound in ornamental cloth gilt, and is very fully illustrated with nearly one hundred cuts, and has an extensive table of contents and index. It is emphatically what its title indicates, a manual of experiments. The publishers send free to all who apply by letter, a large illustrated circular, giving the full scope of the work, with samples of the cuts. It will be supplied by mail post free to any address by Munn & Co. or by the publishers on remittance of the price.

SCIENTIFIC AMERICAN BUILDING EDITION.

JANUARY NUMBER.

TABLE OF CONTENTS.

1. Elegant Plate in Colors of a Dwelling costing about Nine Thousand Five Hundred Dollars, with floor plans, specifications, sheet of details, etc.
2. Plate in Colors of a Dwelling of Moderate Cost, with floor plans, specifications, sheet of details, etc.
3. Illustrations of the Alcazar, and the magnificent Hotel Ponce de Leon, St. Augustine, Fla., also engravings showing the Main Entrance, Ladies' Entrance, and Dining Room. Beautiful examples of the Spanish Renaissance type of Architecture.
4. View of the beautiful Tower of the new Episcopal Church at St. Augustine, Fla.
5. Perspective Drawings of two Substantial Dwellings at Springfield, Mass.
6. Drawing in Perspective, with floor plans, of a Handsome Dwelling, costing Five Thousand Six Hundred Dollars.
7. Perspective view and floor plans of a Dwelling for Th Thousand Two Hundred Dollars.
8. Floor plans and perspective view of a House for Three Thousand Eight Hundred Dollars.
9. Drawing in perspective and floor plan of a Church costing Three Thousand Five Hundred Dollars.
10. Ground plan and perspective view of a Deer or Donkey House costing about One Hundred Dollars.
11. Perspective and ground plan of a Carriage House for One Hundred and Fifty Dollars.
12. Sketch of a Comfortable Dwelling erected in Minneapolis.
13. Side elevations and floor plans of a Dwelling of small cost.
14. Half page engraving of new Evangelical Church, Riedlingen.
15. ngraving of the new Masonic Temple at Newport, Ky.
16. Perspective view and floor plans of a Dwelling for Five Thousand Six Hundred Dollars.
17. A Dwelling for Two Thousand Nine Hundred Dollars. Perspective and floor plans.
18. Drawings of first and second floor plans and perspective of a Handsome Residence in Chattanooga, Tenn.
19. A House costing Seven Thousand Dollars. Perspective and floor plans.
20. A Window in the Cathedral of Murcia, Spain. Half page engraving.
21. Full page illustration of the exterior of Bristol Cathedral.
22. Page engraving of a picturesque Garden Pavilion near Paris.
23. Private Residence of M. Grevy, Ex-President of France.
24. Sketch for a Town Hall.—H. P. Kirby, architect.
25. View of a Country Residence; also sketch for a Tower, by John Calvin Stevens, architect.
26. Miscellaneous Contents: Keep Out the Water.—Improvement in Frescoing.—American Architecture of Fifty Years ago.—Lapageries.—Decision on a Building Contract.—The Creosoting of Wood.—Life of Iron Pipes.—Sanitary Arrangements in a Country House.—Pinus Parviflora.—The Architectural League.—Spots upon Plaster Ceilings.—Straight and Curved Lines in Architecture.—The Murphy System of House Drainage.—Painting Iron Work.—Utility and Beauty in Architecture.—Railroad Snow Sheds.—Frost Glass.—Diminution and Entasis of Colmns.—How Mirrors are Made.—Clay Roofing Tile.—A Sewer Stopped by Tree Roots.—New Plan for a Storage Warehouse.—The Building and Decorative Stones of Egypt.—Gas Fire Radiator.—Architects, Clients, and Builders.—The Mortimer Apartment House.—Sewer Poison.—Metallic Roofing, with illustrations.—Boiling Bricks in Tar.—"Unique" Screw Holding Screw Driver, illustrated.—The Wooden Railways of the United States.—Prevention of Fire in Theaters.

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"Really, how well you look! You are much stouter, and look ten years younger than when I saw you a few years ago. Then I did not think you were long for this world." "No," my friend replied, "four years ago I little expected to be in the land of the living at this time. It had for many years seemed unavoidable that I should have a sick spell in the latter part of January. So regularly had this been the case that my family looked for it. Four years ago an attack of pneumonia in January was followed in February by an attack of neuralgia of the heart. So violent and sudden was the attack, that although within forty rods of my house I was unable to reach it, and was carried into a house near where I had been standing. I soon rallied and was carried home. This was succeeded by two lighter attacks. After recovering so I could be about, I was taken down with three successive attacks of renal calculi. Recovering from these, I was prostrated with a long siege of diarrhœa, from which the attending physician had little hope of my recovery. I had little strength left; little vitality; recuperative powers seemed gone; felt completely prostrated. No life, no ambition, no power. I then commenced the Home Treatment. In a few weeks I was able to try work again, although quite feeble and not able to endure fatigue or much labor. I resorted to the Compound Oxygen more regularly, and to my surprise all the old bad feelings gradually disappeared. Life assumed a brighter aspect. Strength and the elasticity of youth in a great measure returned. And now, though of threescore and four years, I feel younger, brighter, and more active than I did twenty years ago. To Compound Oxygen I give all the credit; and I would recommend all chronically afflicted to try it. Tell all such for me that it will be greatly to their interest if they will call at the office of Drs. Starkey & Palen, 1529 Arch Street, Philadelphia Pa., and get their advice upon their special cases, which is given free."

A volume of two hundred pages on "Compound Oxygen—Its Mode of Action and Results," will be mailed free to all on receipt of address.

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from
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Short line telephones. See illustrated adv., page 28.

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The Knowles Steam Pump Works, 113 Federal St., Boston, and 93 Liberty St., New York, have just issued a new catalogue, in which are many new and improved forms of Pumping Machinery of the single and duplex, steam and power type. This catalogue will be mailed free of charge on application.

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Tight and Slack Barrel Machinery a specialty. John Greenwood & Co., Rochester, N.Y. See illus. adv., p. 28.

Quints' patent automatic steam engine governor. Correspondence solicited from manufacturers of throttle governor engines. Leonard & McCoy, 118 Liberty Street, New York.

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Notes & Queries

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Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information, and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all, either by letter or in this department, each must take his turn.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

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Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(1) Slip of Car Wheels.—Allow me to make the following remark as to your explanation in regard to the locomotive running over a curve, as question solved in your issue of 17th Dec. I claim that in every case the inner wheels will slip, for this reason: For instance, the locomotive is running over a short curve or long curve at their general speed, as whatever it may be, of course its tendency while it met with the curve was to go in a straight line. Now, the change of its direction is due to the curve of the rails in combination with the flanges on the driving wheels (that is, on the outer ones). Thereby more friction is created on them than on the inner ones, consequently the inner wheels will slip easier. The elevation of the outer rail is supposed to partially compensate for the centrifugal force tending to throw the flanges against the outer rail, and as only the flange of the forward driving wheel impinges against the outer rail, there is no reason for concluding that the inner wheels always slip. The whole weight of the locomotive is tended to go in a straight line, as before stated. Now, by meeting with the curve its tendency is being brought in a centrifugal motion, and hence the force being sustained by the outer rails and wheels, thus decreasing the weight of the locomotive on the inner ones, and adding equally as much on the outer. Consequently the inner wheels will slip easier. This is what is claimed in No. 10, Notes and Queries, for a locomotive when drawing. When running under momentum only, the tilting of the locomotive by the elevation of the outer track and the angular position of the truck tends to prevent undue friction on the flange of the forward driver. When the locomotive runs on to a curve reversed, the slip necessarily takes place on the outer rail.

(2) W. H. D. asks how to make a canvas bag to hold hydrogen or oxyyen gas under pressure for magic lantern use. A. Rubber bags are used for this purpose, and you can most conveniently make a canvas bag air-tight by coating it with a layer of rubber cement or a solution of rubber in carbon disulphite.

(3) C. E. asks: What will be the best method to clear a waste pipe where mucus is forming or has formed from waste of beer or water, or what would be best to run through it in order to clear itself? A. Use a strong hot solution of soda.

(4) J. H. A. desires a receipt to stain white pine cherry and rosewood color. A. For cherry stain, take of rain water 3 quarts, annatto 4 ounces, boil in a copper kettle till the annatto is dissolved, then put in a piece of potash the size of a walnut; keep it on the fire for half an hour longer, and it is ready to bottle for use. For rosewood stain, take alcohol 1 gallon, camwood 2 ounces; set them in a warm place 24 hours, then add extract of logwood 3 ounces, aquafortis 1 ounce, and when dissolved it is ready for use.

(5) H. M. P. asks: 1. What battery, what size, and how many cells will it require to run Edison's incandescent 6 candle power lamp, resistance 6 to 7 ohms, requiring 9 to 15 volts E. F. and 1·40 amperes current? A. A series of twenty bichromate cells would give you voltage enough for your lamp. Taking a quart battery, you might allow ½ ohm to each cup. This would give ten ohms internal resistance and would give through a 6 ohm lamp a low lighting current, say 1·25 amperes. 24 square inches of zinc in a porous cup cell are allowed by some per ampere on short circuit. 2. Would this lamp be sufficient candle power to light a room 17 by 17 feet? A. The light would be quite insufficient for the room. 3. How should the batteries be connected? A. The batteries in above calculation are connected in tension. The more you use in parallel, so as to bring down the resistance, the less acid and zinc will be used. See SCIENTIFIC AMERICAN, vol. 57, No. 2, page 16, for article on this subject. 4. What would probably be cost of maintenance per hour? A. The cost per hour depends on so many factors that it cannot be given. It will cost probably one or two cents an hour in chemicals and zincs, irrespective of the trouble. 5. Is it possible to run the lamp with gravity battery? If so, how many cells? A. A gravity battery is not available for this work. 6. Will these lamps develop the power as given by manufacturers? A. The lamps can be run far over the rated power, but they wear out sooner. 7. If this lamp is too small for practical purposes, please give battery, etc., required for 16 candle power lamp. A. For a 16 candle lamp 40 cells in series would answer.

(6) F. M. W. writes: Describe the process of polishing horn. A. It must be rubbed first with fine glass paper and then with a piece of wet linen cloth dipped in powdered pumice stone. This will give a very fine surface, and the final polish may be produced by washed chalk or fine whiting applied by a piece of cloth wetted with soapsuds. Care must be taken in this, and in every instance where articles of different fineness are used, that, previous to applying a finer, every particle of the coarser material is removed, and that the rags are free from grit.

(7) J. G. M. writes: I have recently fitted my main building, 100 x 40 feet and 35 feet high, with lightning rods, having 4 points 8 feet high and having two connections to the ground. Will you kindly tell me the required size and thickness of copper plate for ground connection, whether it should be soldered to the rod or not and whether it should be put at lower end of rod, 6 feet down, or higher up? A. Use a copper plate having about 20 square feet area. Ordinary sheet copper, such as is used for roofing, or in the manufacture of culinary vessels, will answer. The lower end of the rod should extend across the plate and be soldered. The plate should be buried in earth that is always moist. Another way to make a good ground connection is to dig a trench 10 feet long in earth that is constantly moist. Put a layer of coke on the bottom of the trench; loop the rod and lay it on the coke. Cover the rod with a layer of coke and fill in the trench with earth. The trench should extend away from the building.

(8) H. W. K. asks for a cement which can be used to stick art tile to iron. A. Try a gutta percha cement, made by melting together in an iron pan 2 parts of common pitch and 1 part of gutta percha. Stir them well together until thoroughly incorporated and then pour the liquid into cold water. When cold it is black, solid and elastic; but it softens with heat, and at 100° Fah. is a thin fluid.

(9) C. A. F. desires a receipt for preparing white linen cloth so that it can be written on without blotting, at same time making it stiff and glossy and to cut without fraying. A. Varnish the cloth with Canada balsam dissolved in turpentine, to which may be added a few drops of castor oil, but do not add too much, or it will not dry. Try a little piece first with a small quantity of varnish. The kind of cloth to use is fine linen. Don't let the varnish be too thick.

(10) J. H. R. desires a receipt for a wash or any other preparation for the hair that will make it curl. A. Take borax 2 ounces, gum arabic 1 drachm, add hot water (not boiling), 1 quart; stir, and as soon as the ingredients are dissolved add 3 tablespoonfuls of strong spirits of camphor. On retiring wet the hair with the above liquid.

(11) E. H. D. desires (1) recipes for making purple, green, and black copying type writer inks. A. Take any desired shade of aniline dye ½ ounce, dissolved in 15 ounces pure alcohol, and 15 ounces glycerine, then apply to the ribbon. 2. Do strong electric or calcium lights produce sensible effect on photographic preparations? A. Calcium light has little effect, but electric light has an effect which, under sufficient exposure, is as great as sunlight.

(12) H. B. asks (1) for directions for making effervescing solution of citrate of magnesia. A. Dissolve citric acid 400 grains in water 2,000 grains, add carbonate of magnesia 200 grains; stir until dissolved. Filter into a 12 ounce bottle containing sirup of citric acid 1,200 grains. Add boiled and filtered water to fill bottle, drop in bicarbonate of potash in crystals 30 grains and immediately cork. Shake until bicarbonate of potash is dissolved. The sirup of citric acid is made from citric acid 8 parts, water 8 parts, spirit of lemon 4 parts, sirup 980 parts. 2. How much power should I get from a bichromate of potash battery with a zinc plate 3 inches long, 2 inches wide, and 4 arc light carbons 3 inches long and ½ inch in diameter, two on each side of zinc, and what is its resistance? A. Your battery would give about ⅛ ampere, with resistance of 4 ohms.

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INDEX OF INVENTIONS

For which Letters Patent of the United States were Granted

January 10, 1888,

AND EACH BEARING THAT DATE.

[See note at end of list about copies of these patents.]

Advertising frame, R. N. Searles 376,265
Air compressor, G. Chamberlin 376,141
Ammonium sulphate, apparatus for making, W. Simpkin 376,351
Animal trap, A. M. Cleaver 376,142
Animal trap, A. E. Kunderd 376,246
Animals from jumping fences, device for preventing, Booth & Beard 376,065
Annunciator, J. P. Tirrell 376,171
Back band, A. J. Helm 376,091
Band cutter, J. E. Schooley 376,166
Bar. See Plow bar.
Barrel head, J. Alvord 376,223
Barrel holder, E. C. Gillem 376,376
Battery zinc, J. Beattie, Jr 376,228
Bedstead, folding or wardrobe, F. B. Williams 376,127
Bedstead, wardrobe, F. B. Williams 376,126
Belt shifter and trainer, F. L. Palmer 376,339
Belting machine, J. H. Adamson 376,174
Bench dog, D. A. Owen 376,206
Bench hook, A. P. Millspaugh 376,331
Bevel, L. D. Gould 376,301
Bicycle, Filliez & Monnin 376,241
Bit. See Bridle bit.
Block. See Wagon brake block.
Blowers or other machines, intermittent grip for fan, J. F. Bender 376,361
Boiler. See Steam boiler.
Bolt, J. Potter 376,258
Bookmark, reference, H. H. Russell 376,110
Boot and shoe box fixture, mercantile, Cobb & Bowen 376,070
Boot or shoe, H. Effiandt 376,183
Boot or shoe, W. D. Kline 376,154
Boot, woolen, Dodge & Smith 376,373
Boots, manufacture of woolen, Dodge & Smith 376,372
Boots or shoes, manufacture of, Lion & Cutlan 376,411
Boots or shoes, machine for making welts for, M. L. Keith 376,310
Box. See Miter box.
Box for the sale of goods, C. T. Rosenthal 376,261
Brake. See Car brake. Safety brake. Sled brake.
Brick sanding machine. J. 1. Knapp *et al* 376,316
Bridge, draw, O. G. Balston 376,225
Bridle bit, A. H. Hanscom 376,088
Brush, rubber, J. P. Hoyt 376,385
Brushes, handle for mucilage, C. Rowland 376,397
Buckle, T. C. Field 376,240
Buckle, C. R. Harris 376,193
Buckle, E. A. Smith 376,267
Buildings, construction and decoration of, S. D. Hatch 376,380
Bustle, W. F. Osborne 376,394
Bustle, T. P. Taylor 376,272
Button, cuff, F. F. Bioren 376,282
Buttonhole finishing machine, G. S. Hill 376,245
Cake or bread beater, S. F. Stowe 376,420
Calendar, F. W. Moulton 376,391
Can, F. N. Gaskell 376,085
Can filling apparatus, H. Hermann 376,195
Can filling machine, W. H. Wright 376,403
Can for molasses, etc., S. R. Billups 376,064
Car brake, L. Kupferschmid 376,100
Car coupling, F. C. Bailey 376,131
Car coupling, C. G. Crosse 376,237
Car coupling, J. Hendershot 376,244
Car coupling, E. Huber 376,093
Car coupling, O. Hughes 376,386
Car coupling, A. Keeports 376,309
Car coupling, S. D. Locke 376,387
Car coupling, T. W. McKee 376,412
Car coupling, B. B. Morgan 376,335
Car coupling, J. P. Runkel 376,164
Car coupling, C. M. Shupe 376,213
Car starter, H. P. Wayman 376,356
Cars by electricity, lighting, A. D. Stevens 376,116
Cars, track brake for, J. S. Bokenkotter 376,363
Cars with hot air, apparatus for heating, Casselman & McGann 376,138
Carburetor, F. J. Lothammer 376,248
Carriage body, C. A. Reade 376,162
Carriage, child's, T. Lanston 376,201
Carriage spring, J. R. Northrup 376,158
Carriage top, H. B. Pitner 376,414
Carrier. See Hay carrier.
Cartridge shells, loading apparatus for, G. G. Greenough 376,148
Casehardening and cementation compound, G. F. Evans 376,186
Cash carriers, air cushioned counterbalance for, L. G. Bostedo 376,286
Cash carrier apparatus, pneumatic, Pain & Webber 376,159
Cash indicator and register, Schickner & Rothlisberger 376,262
Casting apparatus, hub, F. H. Ensign 376,146
Chain, drive, B. A. Legg 376,325
Chair. See Railway rail chair. Reclining chair.
Chair, D. Parks 376,256
Chair attachment, rocking, W. Seng 376,266
Check hook, W. R. Moore 376,334
Check rein attachment, G. Hosley 376,306
Chisel, J. R. Bailey 376,276
Chopper. See Cotton chopper.
Cigar fillers, mould for measuring and partially shaping, F. A. Ford 376,147
Cigarettes, etc., pocket box for, C. S. Alden 376,056
Clamp, W. D. Hawley 376,304
Clock striking mechanism, W. E. Counter 376,074
Closet. See Water closet.
Closet flushing and regulating device, siphon, P. Harvey 376,090
Cock, sea, F. C. Starke 376,270
Cock, water, J. M. Anderson 376,129
Cock, water, H. D. Medrick 376,253
Cocks, etc., automatic device for shutting water, J. W. Brook 376,287
Coffee pot, A. J. Lane 376,319
Coffin handle, G. C. Frazier 376,407
Coin operated lock, M. Easton 376,182
Color, production of a new red azo, A. Mylius 376,392
Combination table, Riser & Bardonner 376,415
Coop, chicken, G. W. Brown 376,230
Core machine, Mauser & Richmond 376,155
Corn removing knife, C. Langbein 376,320
Cotton chopper, J. B. Ammons 376,274
Cotton chopper, W. P. Clark 376,294
Cotton, etc., machine for opening and cleaning, D. H. Rice 376,346
Coupling. See Car coupling. Pipe coupling. Tug coupling.
Crate, T. W. Lankford 376,321
Cultivator attachment, W. Nave 376,336
Curtain fixture, J. Cremer 376,143
Cutter. See Band cutter.
Dial, indicator, L. L. Mitchell 376,103
Die and die holder for drawing, W. Allderdice 376,222
Digger. See Potato digger.
Display rack, J. M. Laudick 376,318
Ditching machine, tile, W. Skinner 376,352
Door check, W. H. Stevens 376,117
Draught equalizer, W. A. Perkins 376,395
Drawing knife, J. R. Bailey 376,277
Drilling machine, T. H. Ward 376,354
Electric circuit breaker, W. R. Cole 376,071
Electric conductors, pole indicator for, A. Berghausen 376,281
Electric lock, C. A. Tucker 376,121
Electric machine, dynamo, F. Jehl 376,307
Electric machine or motor, dynamo, E. Thomson. 376,120
Electric machines, armature for daynamo, H. Lemp 376,326
Electrical circuit breaker, W. R. Cole 376,072
Elevator, F. L. Palmer 376,340
Elevator safety device, A. C. Ellithorpe 376,374
End gate, J. Clayton 376,405
Engine. See Gas engine. Steam engine.
Envelope for newspapers and other merchandise, R. W. Macgowan 376,249
Envelopes, machine for sealing and stamping, H. J. Moore 376,333
Eraser, rubber, W. Friend 376,081
Explosive derived from phenol, S. H. Emmens 376,145
Fan, power, J. A. Mason *et al* 376,327
Fan, toilet, G. R. Burdon 376,231
Faucet, liquid measuring, H. M. Nye 376,254
Feed mill, T. C. Cadwgan 376,232
Feeding salt to live stock, device for, W. H. Barger 376,360
Fence, W. Van Horn 376,218
Fence machine, Elliott & Reid 376,184
Fence, portable, P. Newby 376,337
Fences, clamp for wire and picket, A. Fickett 376,299
Fifth wheel for vehicles, W. Blume 376,178
File, bill, C. C. Chamberlain 376,140
File, bill, S. Ely 376,185
Filter, rotary or oscillating, J. W. Hyatt 376,095
Fire alarm, circuit, J. P. Barrett 376,133
Fire engines, heater for steam, E. Medden 376,330
Fire engines, speaking tube for, W. E. Cassells 376,067
Fire escape, G. Pritchett 376,160
Fire escape, folding, I. B. Stillman 376,216
Fire extinguisher, W. H. Durant 376,239
Fire extinguishing attachment for car stoves, Ross & Brooker 376,163
Fire proof structure, S. D. Hatch 376,381
Fishing reels and rods, wedge ferrule for, H. Prichard 376,260
Flier frame, H. F. Straw 376,118
Frame. See Advertising frame: Flier frame.
Furnace. See Hot air furnace.
Gauge. See Water gauge.
Garment or coat hanger, G. Pavlik 376,207
Garment protector, S. L. Salomon 376,210
Gas engine, H. K. Shanck 376,212
Gas pressure regulator, M. W. Kidder 376,313
Gate. See End gate. Swinging gate.
Generator. See Steam generator.
Grader, road, O. E. Moats 376,156
Grain binder, W. N. Whiteley 376,123
Grain cradle, F. S. Kretsinger 376,317
Grain separator, N. Nilson 376,157
Grate, H. P. Tallmadge 376,170
Grooving machine, A. V. Allen 376,057
Guard. See Yoke guard.
Guns and ordnance, making, F. J. Seymour 376,168
Hammer, drop, J. Sandage 376,111
Handle. See Coffin handle. Mason's float handle. Tool handle.
Hanger. See Garment or coat hanger.
Harrow, J. M. Childs (r) 10,893
Harvester, corn, A. Hollingsworth 376,384
Harvester, grain binding, S. V. Kennedy 376,199
Hay carrier, W. S. & E. J. Risley 376,109
Hay rake, horse, J. G. Alexander 376,175
Heel burnishing machine, J. H. Buself 376,066
Hog trap, S. Loffer 376,388
Holder. See Barrel holder. Pencil rubber holder. Photographic plate holder. Stub holder.
Hook. See Bench hook. Check hook.
Horse detacher, S. A. Pugh 376,107
Horse tail tie. O. Hasbrouck, Jr 376,151
Hot air furnace, W. Morrison 376,390
Hub boring machine, J. Bieber 376,063
Hub, self-lubricating vehicle, J. V. Hawkey 376,152
Indicator. See Cash indicator.
Injector, W. T. Ewing 376,187, 376,188
Injector, S. L. Kneass 376,315
Inkstand, safety, L. B. Prahar 376,259
Iron or steel, treating, E. D. Wassell 376,421
Jar fastening, W. H. Clarke 376,569
Joint. See Rail joint. Wood joint.
Knife. See Corn removing knife. Drawing knife.
Knitting machine, circular, W. J. McDevitt 376,328
Ladder, step, J. T. Miller 376,102
Ladles, machine for making, I. Hamilton 376,377
Lamp, electric, L. H. Leber 376,323
Lasting machine, F. Chase 376,368
Lead traps, making, J. A. Lowe 376,203
Lock. See Coin operated lock. Electric lock. Nut lock. Safe lock. Seal lock. Wagon lock.
Loom, F. Kesselring 376,312

© 1888 SCIENTIFIC AMERICAN, INC.

Loom let-off mechanism, J. P. Thompson..... 376,353
Lozenge machine, O. R. Chase..... 376,068
Mask, baseball, G. Barnard..... 376,278
Mason's float handle, E. M. Van Duzer..... 376,217
Mattress stuffing machine, E. N. Stephenson..... 376,399
Measure, milk, C. L. Christenson..... 376,293
Measure, rotary grain, Busenbarrick & Mitchell.. 376,367
Measuring distances, instrument for, A. Osborn.. 376,338
Mechanical movement, J. F. Hanley..... 376,303
Metal cylinders, machine for shaping wrought, F. J. Seymour..... 376,167
Milk receiver, B. J. Cady..... 376,291
Mill. See Feed mill.
Miter box, H. D. Lanfair..... 376,300
Mitering machine, J. G. Googins..... 376,192
Moulding machine, wood, W. J. Smith.....376,268, 376,269
Nail making machine, F. F. Raymond, 2d..... 376,208
Nail tongs, A. Wood..... 376,220
Nailing machine, Smith & Evans..... 376,114
Needle blanks, machine for swaging, W. H. Dayton..... 376,144
Nut blanks, method of and machine formaking, S. S. Babbitt..... 376,224
Nut lock, H. C. Bowen..... 376,179
Nut lock, J. A. Saunders..... 376,347
Nuts, machine for counterboring and tapping, J. Gielow..... 376,408
Overshoe, W. Hanley..... 376,378
Pail, lunch, C. M. & L. N. Thayer..... 376,119
Paper box covering machines, cut-off attachment for, H. Inman..... 376,096
Paving and roofing compound, A. Walrath..... 376,172
Paving, composition of matter for, H. Busse..... 376,290
Paving, making artificial or elastic bitumen for, H. Busse..... 376,289
Pencils, compass attachment for, M. Hanower ... 376,379
Pencil rubber holder, J. Hoffman..... 376,196
Photographic plate holder, H. Coppin..... 376,181
Pictures of natural scenery and life, method of and apparatus for producing animated, A. Le Prince..... 376,247
Pipe coupling, J. Armstrong..... 376,130
Pipe coupling, G. H. Benjamin..... 376,061
Pipe wrench, D. R. Porter..... 376,396
Piping, flexible, Wilder & Benjamin..... 376,401
Planter, check row corn, E. N. Williams..... 376,125
Planter, corn, J. W. Craig..... 376,370
Planter, corn, A. Winston..... 376,422
Planter, seed, J. F. Guilmartin..... 376,243
Planter, seed, J. V. Harter..... 376,089
Planters, compensating clutch for corn, J. S. Johnson..... 376,308
Plotter and protractor, W. J. Mitchell..... 376,332
Plow attachment, Null & Bussard..... 376,393
Plow bar, adjustable, C. R. Barfield..... 376,226
Plows, sulky attachment for, N. C. Barnes..... 376,176
Plumbing wall paper, window shades, etc., device for, J. Panyard..... 376,341
Polishing and varnishing machine, J. W. Hussey. 376,198
Polishing powder, manufacture of, V. Seib..... 376,211
Pot. See Coffee pot.
Potassium carbonate, obtaining, F. Brunjes..... 376,366
Potato digger, H. D. Binkley..... 376,229
Potato digger, D. Y. Hallock..... 376,086
Power shears, shear blade for, J. P. Halpin..... 376,087
Power, transmitting, A. Higginson..... 376,383
Press, L. D. Gordon..... 376,300
Press for butter and other plastic material, G. F. Johnson..... 376,097
Printing machines, accumulating sheets for, L. E. Brookes..... 376,288
Printing presses, throw-off mechanism for job, A. P. Barber..... 376,059
Projectile, M. E. Gregg..... 376,302
Projectile, line throwing, J. N. Fletcher..... 376,375
Protector. See Garment protector.
Pulverizing machine, A. D. Searls, Sr., *et al*..... 376,112
Pump, W. J. Hearn..... 376,382
Punch, A. Burrowes..... 376,136
Quilting machine, shuttle driver for, A. Beck..... 376,280
Rack. See Display rack.
Rail joint, G. H. Williams..... 376,402
Railway crossing, cable, E. S. Holden..... 376,153
Railway rail chair, and tie, combined, N. M. Marks..... 376,250
Railway signal, A. B. Blackburn..... 376,362
Railway tie, J. W. Smith..... 376,214
Railway track, G. C. Baker..... 376,132
Railway trains, pipe coupling for, N. Curtis..... 376,075
Rake. See Hay rake.
Rasp cutting machine, J. & G. W. Stokes..... 376,400
Razors, machine for honing, E. Wyttenbach..... 376,221
Reclining chair, A. E. Palmer..... 376,105
Refrigerator, R. Schierenbeck..... 376,263
Regulator. See Gas pressure regulator.
Routing machine, G. K. Birge *et al*..... 376,134
Rubber, apparatus for coating fabric with, J. H. Pearce..... 376,344
Rubber upon one or both sides, machine for coating fabric with India, J. H. Pearce..... 376,343
Rule, folding, A. Ryan..... 376,165
Safe lock, H. Stanynought..... 376,215
Safety brake, H. Brockman..... 376,365
Safety switch, J. B. Batt..... 376,177
Sash cord fastener, M. H. Kinsley..... 376,314
Sash cord fastener, O. C. Seiter..... 376,349
Sash fastener, G. H. Aylworth..... 376,359
Sash fastener, N. McIntyre..... 376,252
Sawmill carriages, steam feed for, J. B. St. Louis. 376,169
Saw swage, H. W. Williams..... 376,128
Saws, feed for stone, N. McIntyre..... 376,251
Screw bolts, machine for finishing heads of, C. D. Rogers..... 376,416
Screw tap, L. Parkerton..... 376,342
Seal lock, Ware & Benjamin..... 376,355
Seed tester, H. A. Goetz..... 376,242
Separator, See Grain separator.
Sewer, shoe, C. K. Sherburne..... 376,118
Sewing machine, J. Bolton..... 376,285
Sewing machine buttonhole attachment, F. Egge. 376,297
Sewing machine feeding attachment, S. D. Tucker..... 376,122
Sewing machine feeding mechanism, J. Bolton.... 376,283
Sewing machine oscillating shuttle driver, J. Bolton..... 376,284
Sewing machine shuttle operating mechanism, J. Bolton..... 376,361
Shaft for steamships, W. H. Brown..... 376,135
Shears. See Sheep shears.
Sheep shears, D. Cameron..... 376,233
Shingle sawing machine, S. S. Morton..... 376,204
Shovels, spades, etc., manufacture of, J. C. Russell..... 376,398
Signal. See Railway signal.
Silicates and carbonates, making alkaline, A. Kayser..... 376,409
Silicates, making alkaline, A. Kayser..... 376,410
Sled, bob, F. L. Beard..... 376,227
Sled brake, J. R. Holt..... 376,197
Sole laying machine, F. W. Coy..... 376,406
Sole, stiffener, etc., inner, A. F. Smith..... 376,419
Speed changer, A. Harding..... 376,150
Spinning spindles, support for, W. T. Carroll..... 376,234
Spring. See Carriage spring. Vehicle spring.
Stanchion, D. Y. Clark..... 376,069
Stave jointing machine, A. D. Catlin..... 376,139
Steak perforator, T. W. Franklin..... 376,080
Steam boiler, W. H. Odell..... 376,205
Steam boiler, sectional, Dimmick & Smith..... 376,371
Steam boiler, sectional, R. Ponnay..... 376,257
Steam engine, G. W. Stewart..... 376,271
Steam generator, sectional, J. Kling, Jr..... 376,098
Steaming and cooking purposes, device for, D. C. Ganter..... 376,084
Steel, treating low, H. A. Harvey..... 376,194
Stereotyping, matrix for, Schreiner & Schott..... 376,348
Stocking supporter, S. B. Ferris..... 376,298
Stone dressing machine, U. Cummings..... 376,296
Stove drum, G. Stephenson..... 376,115
Stove, heating, O. P. Daly..... 376,076
Stovepipe grooving machine, E. G. Wilcox..... 376,173
Stove, safety self-extinguishing car, R. M. Bache. 376,275
Strainer for water under pressure, T. Lee..... 376,324
Stub holder, J. M. Berry, Jr..... 376,062
Sulphite solutions, production of, A. Frank, 376,189, 376,190
Supporter. See Stocking supporter.
Surgeon's appliance, O. Schlatter *et al*..... 376,264
Swinging gate, O. West..... 376,358
Switch. See Safety switch.
Table. See Combination table.
Tanks, attachment for supply, W. B. Chamberlin. 376,292
Tannin extracts, manufacture of, H. M. Rau..... 376,345
Telephonic transmitter, S. E. Beedy..... 376,060
Thermoscopes, receiving, transmitting, and distributing instrument for electro-magnetic, H. J. Haight..... 376,149
Tie. See Horse tail tie. Railway tie.
Tool, combination, J. Angus..... 376,058
Tool handle, W. Millspaugh..... 376,413
Torpedo placer, railway, S. W. Doane..... 376,078
Trap. See Animal trap. Hog trap.
Trousers stretcher, H. E. Galloway..... 376,083
Truck, M. Loree..... 376,389
Truck, car, S. Davis..... 376,077
Truck, hand, S. Rogers..... 376,209
Tubes, method of and means for reducing the diameter of, A. Paterson..... 376,106
Tug coupling, hame, D. Hill..... 376,305
Turning crosshead pins, machine for, B. J. Coates..... 376,235
Type writer cabinet, W. Horrocks..... 376,092
Type writing machine, A. T. Brown..... 376,180
Upsetting machine, Cooke & Carlough..... 376,295
Valve gear, D. F. Gallagher..... 376,082
Valve, pressure regulating, F. Markgraf..... 376,101
Vehicle running gear, P. Emery..... 376,079
Vehicle running gear, Warmington & Bulger..... 376,219
Vehicle spring, H. A. Myers..... 376,104
Vehicle spring, S. H. Raymond..... 376,161
Velocipede, railway, C. L. Collier..... 376,073
Velocipede saddle, E. G. Latta..... 376,322
Ventilator, S. W. Hurlburt..... 376,094
Vise or clamp, hand, A. H. George..... 376,191
Wagon brake block, C. P. Bateman..... 376,404
Wagon lock, I. M. McGonigle..... 376,329
Wall covering, J. A. Shephard..... 376,350
Washing machine, S. S. Barrie..... 376,279
Washing maching, G. F. Dunning..... 376,238
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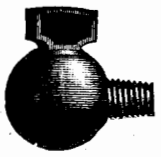
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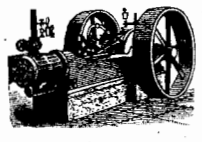
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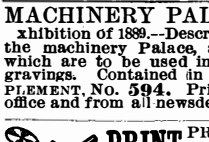
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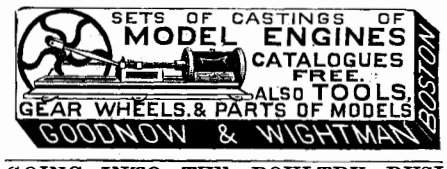

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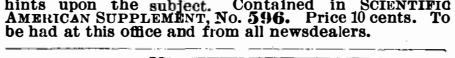
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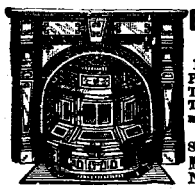

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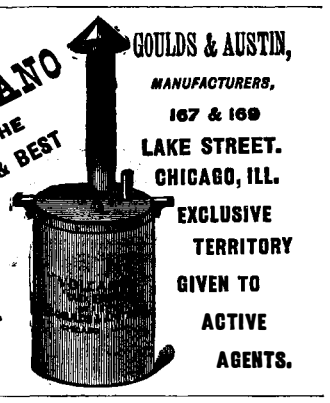
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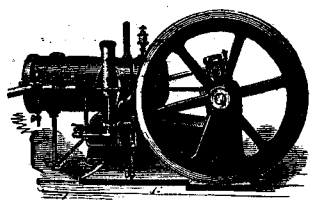

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Proposals for Tools for the Navy Yard, Portsmouth, Virginia.—NAVY DEPARTMENT, Washington, D. C., *January* 12, 1888.—Sealed proposals will be received at this Department until 12 o'clock noon, on Thursday, the 1st day of March, 1888, at which time and place they will be opened in the presence of attending bidders, for furnishing tools and materials required by the Bureau of Construction and Repair, and for the delivery of the same at the Navy Yard, Portsmouth, Virginia. Printed schedules particularly describing the tools, blank forms on which proposals must be made, and all other information essential to bidders can be obtained by regular dealers in, or manufacturers of, the articles required, on application to the Commandant of said Navy Yard. Proposals must be made in duplicate, and enclosed in sealed envelopes marked "Proposals for Tools for the Navy Yard, Portsmouth, Virginia," and addressed to the Secretary of the Navy, Navy Department, Washington, D. C. All bids must be accompanied by either plans or descriptive cuts of the principal tools which the dealer offers to furnish. The Secretary of the Navy reserves the right to reject any or all bids, in whole or in part, as, in his judgment, the interests of the Government may require.
WILLIAM C. WHITNEY, *Secretary of the Navy.*

Proposals for Machine Tools for the Ordnance Gun-Shops.—NAVY DEPARTMENT, WASHINGTON, D. C., *November* 2, 1887.—Sealed proposals will be received at this Department, until 12 o'clock noon, on Thursday, the 1st day of March, 1888, at which time and place they will be opened in the presence of bidders, for furnishing the necessary material and labor and constructing sixteen (16) 16-inch gun lathes, and for the delivery and erection of the same in the Navy Yard, Washington, D. C., in accordance with plans and specifications, copies of which, together with all other information essential to bidders, may be obtained at the Bureau of Ordnance in this Department. Proposals must be made in duplicate, in accordance with forms which will be furnished on application to the Bureau of Ordnance, and enclosed in envelopes marked "Proposals for 16-inch Gun Lathes," and addressed to the Secretary of the Navy, Navy Department, Washington, D. C. The Secretary of the Navy reserves the right to reject any or all bids, as, in his judgment, the interests of the Government may require.
D. B. HARMONY, *Acting Secretary of the Navy.*

NAVY DEPARTMENT, WASHINGTON, *December* 30, 1887.—The time fixed by this Department's advertisement, dated November 2, 1887, for receiving proposals for 6-inch gun lathes, and slotter, is hereby extended to 12 o'clock noon, February 2, 1888, at which hour the opening of the bids will take place. WILLIAM C. WHITNEY, *Secretary of the Navy.*

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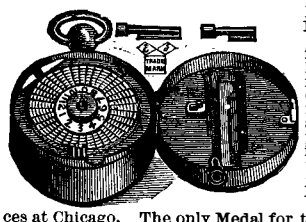

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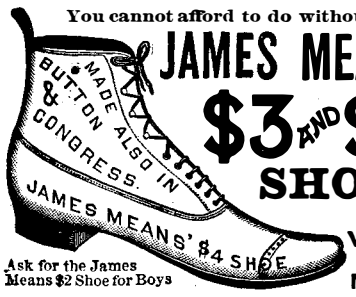

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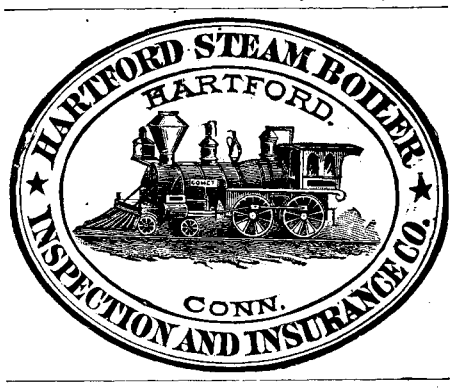

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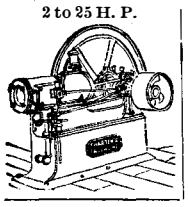

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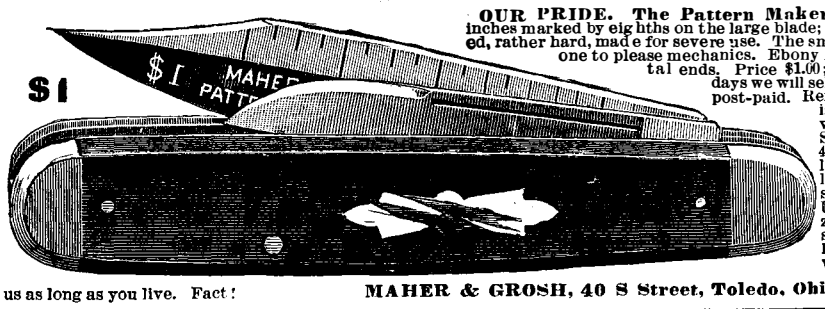

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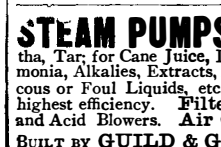

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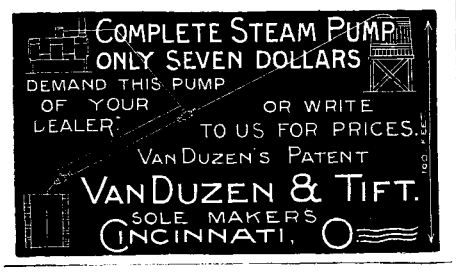

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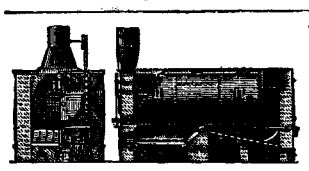

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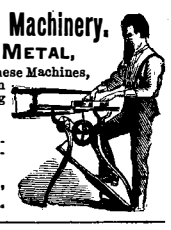

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